



**US Army Corps  
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## **Endangered Species Management Plan for Fort Hood, Texas: FY06–10**

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# **Endangered Species Management Plan for Fort Hood, Texas: FY06–10**

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**Abstract:** Fort Hood Military Reservation is an 87,890-ha U.S. Army installation located in central Texas. It is one of the Army's premier installations, providing training facilities for the full range of mission requirements, including maneuver exercises for units up to brigade level, firing of live weapons, and aviation training. The presence of Federally listed endangered species on Fort Hood is a significant natural resource management challenge for the Army and Fort Hood. In accordance with the Endangered Species Act of 1973, as amended, the Army must assist recovery of all listed threatened and endangered (T&E) species and their habitats under the installation's management authority. Army Regulation (AR) 200-3 requires installations to prepare an Endangered Species Management Plan (ESMP) for all listed and proposed T&E species. The installation ESMP should be used as a tool to achieve conservation objectives for populations of listed and proposed T&E species and to minimize impacts on the training mission. AR 200-3 further encourages, but does not require, the development of ESMPs for all candidate species, and recommends that an integrated ESMP covering all T&E species be prepared if more than one such species occurs on an installation. The U.S. Fish and Wildlife Service Biological Opinion for Fort Hood (March 2005) provides requirements and guidance for endangered species management on Fort Hood. This ESMP is written specifically for use by natural resource managers and leaders of training operations on Fort Hood to accomplish military training objectives while meeting conservation objectives for T&E species. The objective of this ESMP is to provide a comprehensive plan for maintaining and enhancing populations and habitats of Federally listed endangered species and species of concern on Fort Hood while maintaining mission readiness in a manner consistent with Army and Federal environmental regulations.

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# Contents

<b>Figures and Tables .....</b>	<b>vii</b>
<b>Preface .....</b>	<b>viii</b>
<b>Unit Conversion Factors .....</b>	<b>ix</b>
<b>1 Introduction .....</b>	<b>1</b>
Background .....	1
Objective .....	2
Approach .....	3
Mode of Technology Transfer .....	4
<b>2 Site Description and Land Use Activities .....</b>	<b>6</b>
Mission and History .....	6
Terrain .....	6
Maneuver Training .....	7
Live-fire Training .....	10
Aviation Training .....	11
Operational Testing .....	12
Controlled/Prescribed Burning .....	12
Juniper Cutting .....	14
Grazing .....	15
Cowbird Control Program .....	15
Recreation .....	16
<b>3 Species Accounts and Current Status on Fort Hood .....</b>	<b>17</b>
Golden-cheeked Warbler .....	17
<i>Nomenclature and Classification</i> .....	17
<i>History of the Taxon</i> .....	17
<i>Description</i> .....	18
<i>Geographic Distribution</i> .....	18
<i>Migration</i> .....	19
<i>Habitat</i> .....	19
<i>Food Resources</i> .....	21
<i>Population Estimates</i> .....	22
<i>Survival and Dispersal</i> .....	24
<i>Reproductive Biology</i> .....	25
<i>Interactions with Other Species</i> .....	25
<i>Threats to Survival</i> .....	27
Black-capped Vireo .....	29
<i>Nomenclature and Classification</i> .....	29
<i>History of the Taxon</i> .....	30
<i>Description</i> .....	30

Geographic Distribution .....	31
Migration.....	31
Habitat .....	32
Food Resources.....	34
Known Population .....	34
Territory Size and Density.....	35
Survival .....	35
Reproductive Biology .....	37
Interactions with Other Species .....	38
Threats to Survival .....	39
<b>Texabama Croton.....</b>	<b>40</b>
Nomenclature and Classification .....	40
History of the Taxon .....	40
Description .....	41
Geographic Distribution and Known Population .....	41
Habitat .....	42
Reproductive Biology .....	43
Survival and Growth.....	43
Interactions with Other Species .....	44
<b>Cave-adapted Fauna .....</b>	<b>44</b>
Nomenclature and Classification .....	45
Population Estimates .....	50
Geographic Distribution .....	51
Threats to Survival .....	51
<b>Salamander (<i>Plethodon albagula</i>) .....</b>	<b>52</b>
<b>Other Species .....</b>	<b>52</b>
Bald Eagle.....	52
Whooping Crane.....	53
Peregrine Falcon .....	53
<b>4 Conservation Actions: All Federally Listed Species .....</b>	<b>54</b>
Objective 1.....	54
Objective Justification .....	54
Conservation Actions .....	54
Objective 2.....	54
Objective Justification .....	55
Conservation Actions .....	55
Objective 3.....	56
Objective Justification .....	56
Conservation Actions .....	56
Objective 4.....	56
Objective Justification .....	57
Conservation Actions .....	57
Objective 5.....	57
Objective Justification .....	58
Conservation Actions .....	58

Objective 6 .....	58
<i>Objective Justification</i> .....	58
<i>Conservation Actions</i> .....	58
Objective 7 .....	59
<i>Objective Justification</i> .....	59
<i>Conservation Actions</i> .....	59
<b>5 Conservation Actions: Golden-cheeked Warbler .....</b>	<b>60</b>
Objective 1 .....	60
<i>Objective Justification</i> .....	60
<i>Conservation Actions</i> .....	60
Objective 2 .....	61
<i>Objective Justification</i> .....	61
<i>Conservation Actions</i> .....	61
Objective 3 .....	62
<i>Objective Justification</i> .....	62
<i>Conservation Actions</i> .....	62
Objective 4 .....	62
<i>Objective Justification</i> .....	63
<i>Conservation Actions</i> .....	63
Objective 5 .....	63
<i>Objective Justification</i> .....	64
<i>Conservation Actions</i> .....	64
<b>6 Conservation Actions: Black-capped Vireo .....</b>	<b>66</b>
Objective 1 .....	66
<i>Objective Justification</i> .....	66
<i>Conservation Actions</i> .....	66
Objective 2 .....	66
<i>Objective Justification</i> .....	67
<i>Conservation Actions</i> .....	67
Objective 3 .....	67
<i>Objective Justification</i> .....	67
<i>Conservation Actions</i> .....	68
Objective 4 .....	68
<i>Objective Justification</i> .....	68
<i>Conservation Actions</i> .....	69
Objective 5 .....	69
<i>Objective Justification</i> .....	70
<i>Conservation Actions</i> .....	70
<b>7 Conservation Actions: Texabama Croton .....</b>	<b>72</b>
Objective 1 .....	72
<i>Objective Justification</i> .....	72
<i>Conservation Actions</i> .....	72
Objective 2 .....	72
<i>Objective Justification</i> .....	72

Conservation Actions .....	72
<b>8 Conservation Actions: Cave-adapted Fauna .....</b>	<b>73</b>
Objective 1 .....	73
Objective Justification .....	73
Conservation Actions .....	73
Objective 2 .....	74
Objective Justification .....	74
Conservation Actions .....	74
Objective 3 .....	74
Objective Justification .....	74
Conservation Actions .....	74
Objective 4 .....	74
Objective Justification .....	75
Conservation Actions .....	75
<b>9 Conservation Actions: Other Species.....</b>	<b>76</b>
Objective 1 .....	76
Objective Justification .....	76
Conservation Actions .....	76
Objective 2 .....	76
Objective Justification .....	76
Conservation Actions .....	77
Objective 3 .....	77
Objective Justification .....	77
Conservation Actions .....	77
Objective 4 .....	77
Objective Justification .....	77
Conservation Actions .....	78
<b>References.....</b>	<b>79</b>
<b>APPENDIX A.....</b>	<b>87</b>
<b>Report Documentation Page.....</b>	<b>132</b>

## Figures and Tables

### Figures

Figure 1. Training Area designations for Fort Hood, Texas. ....	9
Figure 2. Golden-cheeked warbler and black-capped vireo habitats on Fort Hood, Texas.....	22
Figure 3. Mean detections/point/year of the golden-cheeked warbler increased during 1992–2005 on Fort Hood Military Reservation, Texas, USA.....	23
Figure 4. Return rate of male golden-cheeked warblers differed among 2000–2005 on Fort Hood .....	24
Figure 5. Pairing success for territorial male golden-cheeked warblers did not differ among 2000–2005 on Fort Hood .....	29
Figure 6. Return rates of banded black-capped vireos to study areas on Fort Hood, Texas, from 1997 to 2005 .....	36

### Table

Table 1. Federal endangered, threatened, candidate species and species of concern that occur or may occur on Fort Hood .....	3
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## Preface

This work was performed during 2005 as part of Work Unit BF3279, “Research of Endangered Species Management Plan Implementation.” The Technical Monitor was John D. Cornelius.

This work was conducted under the guidance of Dr. Timothy J. Hayden, Ecologist, U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC/CERL). III Corps and Fort Hood provided funding for this work under reimbursable project order, military interdepartmental purchase request, MIPR5ECERL0276.

Several individuals provided data, information, and review for this effort, including Tim Marston and Charles Pekins of the Fort Hood Natural Resources Branch; Gil Eckrich, contractor; and Rebecca Peak and David Cimprich of The Nature Conservancy. The authors thank the legion of dedicated field workers and installation staff who, over the years, have collected the data and performed the management activities that have led to the successful support of the military mission and conservation of endangered species on Fort Hood.

At the time this work was performed, Steve Hodapp was the TES Program Manager; Alan Anderson was Chief, CEERD-CN-N; and Dr. John T. Bandy was Chief, CEERD-CN. The associated Technical Director was Dr. William D. Severinghaus, CEERD-CV-T. The Director of CERL was Dr. Ilker Adguzel. Colonel Richard B. Jenkins was Commander and Executive Director of ERDC. Dr. James R. Houston was Director.

## Unit Conversion Factors

Multiply	By	To obtain
acres	0.40	hectares
feet	0.3048	meters
miles	1.609344	kilometers

# 1 Introduction

## Background

Fort Hood Military Reservation is an 87,890-ha (217,180 acres) U.S. Army installation located in central Texas. Fort Hood provides resources and training facilities for active and reserve units in support of the Army's mission. This mission is to maintain a total force, trained and ready to fight, to serve our nation's interests both domestically and abroad, and to maintain a strategic force capable of decisive victory. Fort Hood is one of the Army's premier installations in support of this mission. The full range of mission-related training activities, including maneuver exercises for units up to brigade level, firing of live weapons, and aviation training, are conducted on Fort Hood.

In addition to these activities, the Army allows a number of other non-military uses of the land on Fort Hood, including grazing, fishing, hunting, and other types of recreational activities. These uses, together with military training, affect the soil, water, vegetation, and animals that occur on the installation.

The presence of federally listed endangered species on Fort Hood (Table 1) is a significant natural resource management challenge for the Army and Fort Hood. In accordance with the Endangered Species Act (ESA) of 1973, as amended, the Army must assist in recovery of all listed threatened and endangered (T&E) species and their habitats under the Army's land management authority.

Army Regulation (AR) 200-3 requires installations to prepare an Endangered Species Management Plan (ESMP) for all listed and proposed T&E species. The installation ESMP should be used as a tool to achieve conservation objectives for populations of listed and proposed T&E species and to minimize impacts on the training mission. AR 200-3 further encourages, but does not require, the development of ESMPs for all candidate species and species of concern. AR 200-3 recommends that installations prepare an integrated ESMP covering all T&E species if more than one such species occurs on an installation. The U.S. Fish and Wildlife Service

Biological Opinion for Fort Hood (16 March 2005; Appendix A) provides terms and conditions for endangered species management on Fort Hood.

The greatest T&E species challenge on Fort Hood is management of significant breeding populations of two endangered avian species: the black-capped vireo (*Vireo atricapilla*) and golden-cheeked warbler (*Dendroica chrysoparia*). U.S. Fish and Wildlife Service (USFWS) recovery team meetings have recognized that populations on Fort Hood are important for range-wide recovery of these two species. In addition to these species, Fort Hood provides habitat for a variety of endemic cave-restricted fauna, potential transient occurrences of listed species, and other species of concern (Table 1).

To ensure that the full range of military training can be effectively accomplished on Fort Hood, the Army has developed this comprehensive, integrated ESMP for management of endangered species on Fort Hood. Despite military training activities on Fort Hood, the installation presents a much less hostile environment for endangered species than most of the surrounding landscape, which is dominated by ranching, intensive agriculture, and rapid urban development. Through implementation of this ESMP, Fort Hood is in a vital and unique position to help conserve and recover listed species.

This ESMP is written specifically for use by natural resource managers and leaders of training operations on Fort Hood to accomplish military training objectives while meeting conservation objectives for federally listed species and species of concern. Implementation of this ESMP will also assist USFWS in achieving recovery objectives for these species and will provide a guide for natural resource personnel at other military installations facing similar endangered or sensitive species management and land use requirements.

## **Objective**

The objective of this ESMP is to provide a comprehensive plan for maintaining and enhancing populations and habitats of federally listed endangered species and species of concern on Fort Hood while maintaining mission readiness in a manner consistent with Army and Federal environmental regulations.

**Table 1. Federal endangered, threatened, candidate species and species of concern that occur or may occur on Fort Hood. There are several endemic cave invertebrates and a salamander species found on Fort Hood that may eventually become candidate or listed species (see text).**

Common name	Scientific name	Listing status <sup>a</sup>	Status <sup>b</sup>
<b>FEDERALLY LISTED SPECIES</b>			
Crane, whooping	<i>Grus americana</i>	E	B
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	B
Vireo, black-capped	<i>Vireo atricapilla</i>	E	A
Warbler, golden-cheeked	<i>Dendroica chrysoparia</i>	E	A
<b>CANDIDATE SPECIES</b>			
Salado salamander	<i>Eurycea chisholmensis</i>	C	C
Smalleye shiner	<i>Notropis buccula</i>	C	C
<b>SPECIES OF CONCERN</b>			
Peregrine falcon	<i>Falco peregrinus anatum</i>	N/A	B
Texabama croton	<i>Croton alabamensis</i> var. <i>texensis</i>	N/A	A
Salamander (new species)	Under taxonomic review	N/A	A
Cave invertebrates	See text.	N/A	A
<sup>a</sup> Federal listing status; E = endangered, T = threatened, C = candidate <sup>b</sup> Status refers to population status on Fort Hood according to these definitions: (A) Population established on Fort Hood. Recent information documents an established breeding population (even if small) or regular occurrence on the installation. This includes those species for which research and management is ongoing and several endemic cave invertebrates. (B) Recently recorded on Fort Hood, but there is no evidence of an established population. This includes species considered to be transient, accidental, or migratory (e.g., some migrating birds may use the installation as a stopover site during migration to and from their wintering grounds). For some species in this category, further inventory may reveal breeding populations. (C) Not known to occur on Fort Hood. These species are not considered further in this ESMP.			

## Approach

Development of this ESMP is based on the concept of adaptive management. Adaptive management is founded on the idea that management of renewable natural resources involves a continual learning process (Walters 1986). This concept is a key guiding principle in the Department of Defense's ecosystem management policy (S. Goodman memorandum, 8 Aug 1994) and is promoted as an effective approach to successful T&E species recovery.

An adaptive management approach recognizes that protection and management actions are often implemented, by necessity, with imperfect knowledge. Recognition of this uncertainty allows development of monitoring and research approaches to progressively improve knowledge, and thus enhance decision-making and management capabilities.

This ESMP is based on the premise that protection, management, inventory, monitoring, and research are necessary components of an integrated, adaptive management approach for endangered species on Fort Hood. In this ESMP, objectives, justifications, and actions are developed and implemented under a framework that is mutually supportive of these components.

Fort Hood is in the fortunate position of being able to draw on several years of natural resource and endangered species inventory, monitoring, and research data in developing this ESMP. The endangered species research and monitoring programs implemented by Fort Hood since 1987 are regarded by the environmental and scientific community as among the most comprehensive and credible sources of information available for the endangered golden-cheeked warbler and black-capped vireo. Information for this ESMP was gathered from installation project status reports, from related published reports, reports from cave research, and other published and unpublished documents. Personnel from the U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department, The Nature Conservancy, and the Army provided data on distribution and abundance of endangered species on and around Fort Hood.

Even with this wealth of available knowledge, this ESMP recognizes the current state of knowledge is incomplete in many cases and further reinforces the adaptive management concept as a necessary and continual learning process for management of endangered species and species of concern on Fort Hood. AR 200-3 provides the mechanism for incorporating new information and approaches by requiring annual reviews and major revision of this ESMP every five years.

## **Mode of Technology Transfer**

This ESMP is written to meet requirements of AR 200-3, the 16 March 2005 USFWS Biological Opinion for Fort Hood, and the ESA. It will be distributed to military and natural resource managers at Fort Hood, U.S.

Army Installation Management Authority (IMA), Headquarters Department of Army (HQDA), and to state and federal resource management agencies.

This plan will be reviewed annually and updated as required to meet conservation goals and Army mission requirements. This ESMP will be incorporated by inclusion or by reference into the installation Integrated Natural Resources Management Plan (INRMP). Once every five years, the INRMP, including the ESMP section, must undergo major revision to all parts (AR 200-3, 9-4).

## **2 Site Description and Land Use Activities**

### **Mission and History**

Fort Hood Military Reservation encompasses 87,890 ha (217,180 ac) located in central Texas in Bell and Coryell Counties adjacent to the city of Killeen. Fort Hood lies at the northern extent of the Edward's Plateau between the cities of Waco, 64 km (40 mi) to the northeast, and Austin, 97 km (60 mi) to the south.

Fort Hood dates to 1942 when the Army established Camp Hood to prepare soldiers for tank destroyer combat during World War II. Renamed Fort Hood, it became a permanent installation in 1950. Various armored divisions have been assigned to Fort Hood since 1946.

Fort Hood is the only installation currently assigned two divisions. The installation provides the infrastructure and training lands for the 1st Cavalry Division and the 4th Infantry Division (Mech), III Corps Headquarters and its combat aviation assets, combat support, and combat service support units. With increased emphasis on force structure changes and Base Realignment and Closure (BRAC) initiatives, Fort Hood likely will remain the largest active U.S. installation in terms of assigned personnel. Total assigned personnel authorization is approximately 50,000 soldiers.

Fort Hood provides state-of-the-art facilities to support the full spectrum of training requirements of today's modern armed forces. Installation lands and ranges provide excellent training opportunities for mechanized maneuver and small unit exercises, combined arms training, and live-fire training.

### **Terrain**

Fort Hood lies entirely within the Lampasas Cutplains physiographic region and is within the Grand Prairies Land Resource Zone. The forces creating the Balcones Fault Zone, just east of the installation, have uplifted underlying rock formations as much as 152 m (498 ft). Weathering and erosion over the past two million years have produced the present "cut-



plains” landscape characterized by the stair-step topography of a dissected remnant plateau. Numerous steep sloped mesas rise above the flat to gently rolling plains. This benching is the result of erosion-resistant limestone cap rocks of the plateau and mesa-hill structures. These formations are generally composed of massive, structurally sound limestone or a mix of limestone and shale known as marl, which crumbles and weathers. Soil cover generally is shallow to moderately deep, clayey, and underlain by limestone bedrock. Major soil associations are described in Tazik et al. (1992).

Elevation ranges from 180 m (590 ft) to 375 m (1,230 ft) above sea level with 90 percent of the area below 260 m (853 ft). Higher elevations occur on the western portions of Fort Hood and the lowest at the Belton Lake shoreline adjoining the installation on the east. Surface water drains mostly in an easterly direction. Most slopes are in the two-to-five percent range. Lesser slopes occur along flood plains, while slopes in excess of 45 percent occur as bluffs along flood plains and as side slopes of mesa-hills.

Fort Hood lies in the Cross Timbers and Prairies vegetation area of Texas, which normally is composed of oak woodlands with grass undergrowth. Woody vegetation on the installation is derived mostly from the Edward’s Plateau vegetation community to the southwest and is dominated by Ashe juniper (*Juniperus ashei*), Plateau live oak (*Quercus fusiformis*), and Texas red oak (*Quercus buckleyi*). The grasses are derived from the Blackland Prairie area to the east. Under climax condition, these would consist of little bluestem (*Schizachyrium scoparium*) and Indian grass (*Sorghastrum* ssp.).

## Maneuver Training

Maneuver training exercises are conducted at all unit levels to ensure a combat-ready fighting force. Training programs focus on units attaining and maintaining proficiency in collective tasks that support mission-essential tasks. Units involved in the training process span all echelons from section to corps. III Corps’ primary training focus at Fort Hood is the brigade level and below.

Units train as they will fight. Training exercises replicate combat conditions as closely as possible. Combat effects such as smoke, noise, and simulated nuclear, biological, and chemical conditions are integrated into

every training event to condition units for operations in a difficult, stressful battlefield environment. Trainers are careful not to “simulate” or “assume away” any facet of a training mission. For example, units conducting defensive operations “dig-in” vehicle fighting positions and actually emplace the barrier and obstacle plan in those areas that have been previously approved for sub-surface excavation by environmental and archaeological managers. This level of training realism ensures a high level of combat readiness.

Units train for combat in a task-oriented manner. Trainers integrate combat, combat support, and combat service support elements to conduct multi-echelon, combined arms training. Combined arms training involves formations that include members of the entire fighting force. Commanders synchronize the activities of these forces within a battlefield framework that includes maneuver and operations within the deep, the close-in, and rear battle areas. Such exercises involve greater depth and rapidity of movement dimensions and, therefore, also incur greater demands for concurrent land use.

Maneuver training areas are located west, east, and southwest of the Live-Fire Areas (Fig. 1). Maneuver training areas constitute 53,300 ha (131,707 ac) or 61 percent of the entire installation. The West Range Maneuver Training Areas (Land Groups 4–6) provide excellent training opportunities for large armored and mechanized infantry forces. The training area averages seven to 10 km (4.3–6.2 mi) east to west and 30 km (18.6 mi) north to south. The area features a wide variety of terrain and vegetation characteristics that greatly enhance cross-country, combined arms maneuver. Because of its large, contiguous size, this is the only maneuver area on Fort Hood capable of supporting brigade-level operations.

The Northeast (Land Groups 1 and 2) and Southeast Range Maneuver Training Areas (Land Group 3) are divided by Belton Lake Reservoir. The northeast sector is heavily vegetated and cross-compartmentalized, providing limited value as a mechanized maneuver area. The southeast sector provides more favorable terrain for mechanized units, but is only four to seven km (2.5–4.3 mi) north to south and 15 km (9.3 mi) from east to west. Because of limited area, the Northeast and Southeast Range Maneuver Training Areas are best suited for unit assembly and logistical areas, artillery firing points, and company- and platoon-level mounted and dis-

mounted training. Also, these eastern training areas support engineer, combat support, and combat service support training, and provide locations for amphibious and river crossing operations.

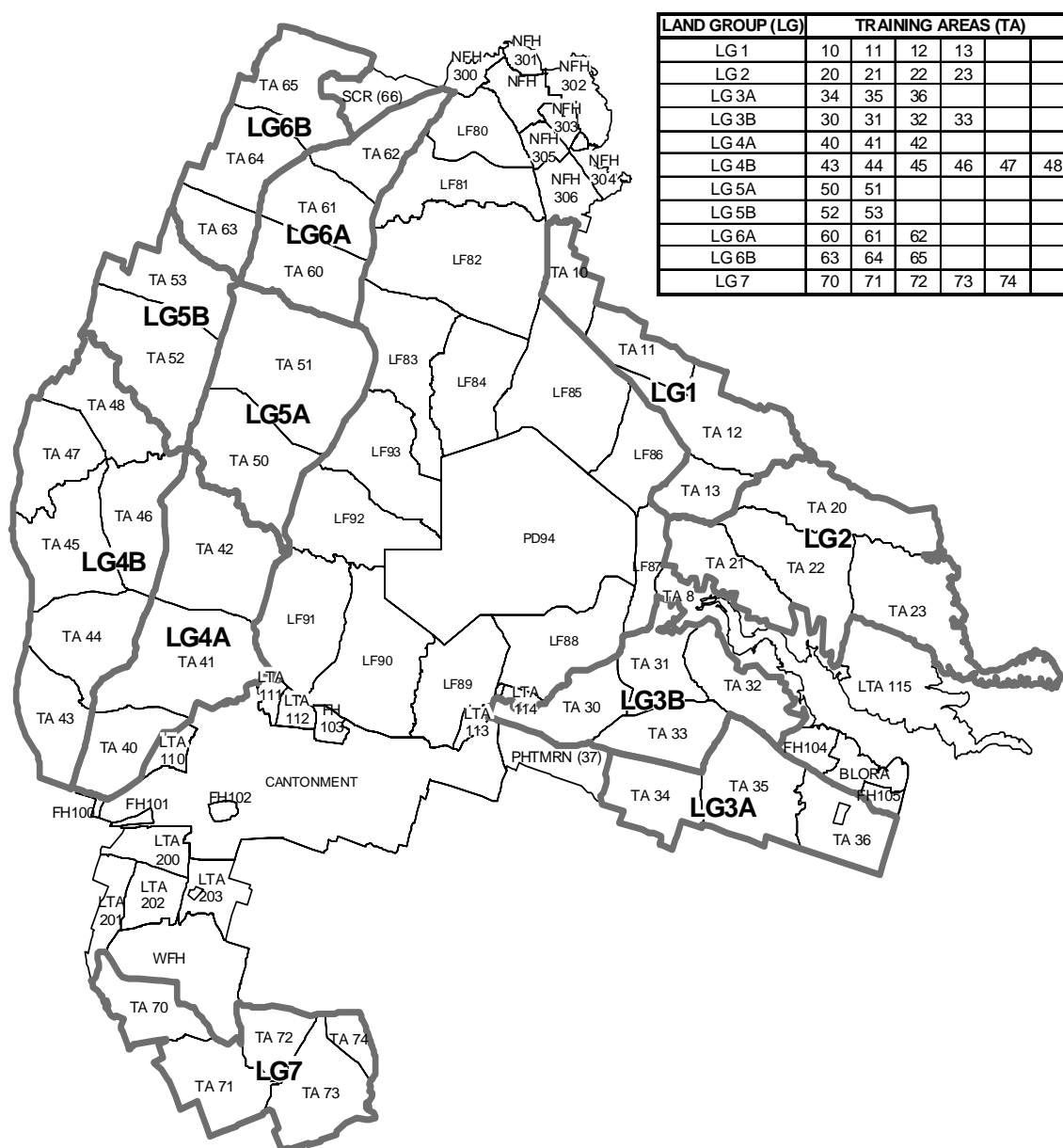


Figure 1. Training Area designations for Fort Hood, Texas.

TA = Training Area. PD = Permanently Dudded area. LF = Live-Fire training area.  
 WFH = West Fort Hood. LG = Land Group. LTA = Local Training Area. NFH = North Fort Hood.  
 FH = Fort Hood. BLORA = Belton Lake Outdoor Recreation Area.

The Southwest Maneuver Training Area is not used for maneuver training because of its small size and isolated location. The Southwest Maneuver Training Area (Land Group 7; “Southwest Fort Hood”) is separated from the main cantonment area by U.S. Highway 190. This training area includes many restricted areas, including Robert Gray Army Airfield and the Ammunition Supply Point (ASP). The Southwest Maneuver Training Area is used primarily for small mechanized unit and dismounted infantry training and for logistical sites.

## **Live-fire Training**

Weapons proficiency is a critical component of combat power. Fort Hood units train with the most modern and sophisticated weapon systems available. These weapons are constantly evolving to stay ahead of advancements in armament technology by threat forces. Fort Hood has some of the most modern live-fire training ranges in the world. These ranges provide realistic combat conditions and scenarios to train crews to exacting standards of gunnery proficiency as well as test the capabilities of new weapons systems. Live-fire training facilities must be continuously upgraded to keep pace with evolving technology and changes in war fighting doctrine. Fort Hood uses a 5-Year Range Modernization Program to manage upgrades and expansion of existing facilities and new construction projects to meet future training and evaluation requirements. Live-fire training facilities are located primarily in Live-Fire Areas (LF) 80–93 and Permanent Dudded Area (PD94; Fig. 1).

The Live-Fire Areas and PD94 (Fig. 1) cover about 24,000 ha (59,305 ac) in the central portion of the installation, bounded on the east, west, and south by the East Range, West Range, and South Range roads, respectively. Direct fire occurs inside these roads, and is directed toward PD94 and other target arrays. Indirect fire from artillery and Multiple Launch Rocket Systems (MLRS) is directed from numerous locations in surrounding maneuver areas. Much of the Live-Fire Area provides a buffer zone for PD94 and has limited impacts from exploding ordnance. The Live-Fire Areas provide training and evaluation facilities for all individual, crew-served, and major weapons systems, up to and including brigade live fire. These Live-Fire Areas are used by all active units assigned to III Corps and Fort Hood, as well as by attached units from the Army National Guard and the Army Reserve.

Modernized live-fire training facilities require continuous maintenance to maximize range design capability. Sensor devices must be serviced and cleared of concealing vegetation to ensure unimpaired operation. Target arrays must be visible at maximum engagement ranges. A program of range maintenance to routinely clear vegetation from target arrays and sensor devices is a critical component of range operation.

## **Aviation Training**

Fort Hood has one of the largest military aviation commands in the United States. The aircraft, primarily rotary-wing, are some of the most modern and sophisticated in the world. Aviation units on Fort Hood train at all levels from individual through battalion/squadron.

The training tasks accomplished in the training areas (Fig. 1) include all tactical maneuvers in accordance with each aircraft's aircrew training manual and the unit's standard operating procedures. This includes nap-of-earth, contour, and low-level flight. Fixed-wing aircraft of the Air Force and Air National Guard also conduct training missions in Fort Hood air space and use impact areas on the installation for weapons delivery practice.

Two major airfields are located on Fort Hood. The Hood Army Airfield is a 293-ha (724-ac) area located at the eastern end of the cantonment area. Hood Army Airfield is the primary airfield for rotary-wing air operations and has a 1,436-m (4,712-ft) runway. Robert Gray Army Airfield is an 867-ha (2,142-ac) area located at West Fort Hood with a 3,050-m (10,000-ft) runway. Several dirt landing strips are located on the installation for tactical air supply and support training.

Aircraft gunnery for AH-64 units is conducted on multi-purpose training ranges and PD94. However, the Dalton-Henson Range Complex (LF 80–82) is used most often for this training. Hellfire Missile Shots are conducted at Blackwell Multi-Use Range's Impact Area (PD94). Helicopter Door Gunnery is primarily conducted at Dalton Mountain Range or Crittendenburger Range (LF 85–86). National Guard and Army Reserve units use the Dalton-Henson Range Complex for aviation training.

## Operational Testing

Fort Hood's large maneuver and Live-Fire Areas, coupled with III Corps' modernized force, provide excellent conditions for operational testing of various weapons, equipment, and doctrine. The U.S. Army Operational Test Command (OTC) is a tenant activity located at West Fort Hood directly involved in training, doctrine, and combat development of the products that soldiers use on a daily basis and will use on the future battlefield.

Most OTC tests employ "user testing," allowing front-line soldiers to try out new equipment or concepts. The tests generally encompass activities similar to those described in this report's sections on maneuver, live fire, and aviation training.

## Controlled/Prescribed Burning

Prescribed fire is a natural, economical, and effective management practice in some ecosystems. During the past 150 years in Texas, fire suppression practices have contributed substantially to the ecological imbalance of endangered species habitats. In many instances, properly applied fire can be one of the better tools to correct this problem. Fire presents a particular dilemma for the management of endangered species on Fort Hood. Recovery times differ for golden-cheeked warbler and black-capped vireo habitats after a stand-replacing fire. Golden-cheeked warbler habitat that burns on Fort Hood generally regenerates first as black-capped vireo habitat in two to five years. Regeneration to golden-cheeked warbler habitat can require 25 or more years post-disturbance. Because of fire's potential effects, both positive and negative, on endangered species habitats, it plays an important role in management of endangered bird species habitats on Fort Hood.

During extremely hot and dry conditions in late February 1996, approximately 2,728 ha (6,741 ac) of endangered species habitat were burned by wildfires on Fort Hood. This included about 2,313 ha (5,716 ac) of warbler habitat and 415 ha (1,025 ac) of vireo habitat. The golden-cheeked warbler habitat that burned substantially converted to black-capped vireo habitat during the subsequent 2–5 years.

New fire protection policies have been implemented on Fort Hood as a result of the 1996 fires and consultation with the USFWS. Fort Hood cur-

rently has a fire danger rating system to alert trainers when pyrotechnic operation should be limited or halted based on current (daily) weather and estimated moisture content of vegetation and soil. Details of this rating system are found in OPLAN 8-93, "Operation Brush Fire," and Fort Hood Regulation 350-40. These fire ratings are

**Condition Green:** No restrictions on training. Troops may use pyrotechnics and incendiary munitions for training.

**Condition Amber:** Caution must be taken in use of pyrotechnics. Aerial flares are not to be used outside the impact area. Other pyrotechnics are to be used only in roadways, tank trails, in areas clear of vegetation, or in containers.

**Condition Red:** No pyrotechnics or incendiary munitions authorized for training purposes.

**Condition Red with Waiver:** Once a risk assessment is conducted by Range Control and the recommendation for training with waiver is approved by the Director, Range Control, specific restrictions are imposed on training units.

Currently, under all fire condition ratings, fires are reported to Range Control by military units or installation personnel. If the fires are within range fans where live-fire training is being conducted, units will cease firing until a fire risk assessment is conducted or control measures are implemented. Range Control will determine the location of the fire and risk to facilities, personnel, or sensitive resources such as endangered species habitats. If Range Control determines there is no risk to facilities or habitats, the fire will be allowed to burn. Typical examples are fires occurring in the permanently duded impact area (PD94; Fig. 1) where fires are extremely frequent and fuel loads are low. If a fire may risk endangered species habitat, Range Control will contact the installation Natural Resources Management Branch (NRMB) for an assessment of the risk based on proximity to high hazard areas, fuel load, topography, and other parameters. If the fire risk to habitats is obviously high, Range Control may immediately implement fire control actions concurrent with notification of the NRMB. Within the Live-Fire Areas, the first response is usually by a contracted helicopter on standby for fire control. Under Condition Red this helicopter

is on 30-minute standby during 1100–1800 and two-hour standby during the rest of the day/night period. Other installation fire-fighting assets are available for fire control as needed.

Fort Hood will establish a “let burn” policy for range fires that occur during periods when Fire Danger Rating is Green or Amber. Under Green and Amber ratings, fires will be allowed to burn in all habitat areas within the Live-Fire Area unless there is obvious threat to personnel or facilities or until such time as changing environmental conditions warrant implementing increased fire control procedures.

Current prescribed burn policy emphasizes reduction of fuel loads in grasslands surrounding endangered species habitats on Fort Hood. Prescribed burn policies emphasize use of preventative prescribed fire to maintain blacklines near habitat areas annually. Fort Hood employs fire-breaks in association with endangered species habitats to reduce fire risk. Reduction of fuel loads mitigates the threat of wildfire damage in these habitats. Prescribed burns are managed through the Fort Hood NRMB. Other objectives of the installation prescribed burn program are to reduce encroachment of Ashe juniper in all range sites, improve vegetation composition, and improve wildlife habitats.

## **Juniper Cutting**

After the listing of the golden-cheeked warbler in May 1990, juniper cutting on Fort Hood was suspended temporarily following informal consultation with the USFWS. Since Ashe juniper is an essential component of the habitat for this endangered bird species, it was determined that juniper cutting could have a negative impact.

During the period 1997–2000, under an agreement with the Natural Resources Conservation Service (NRCS), Fort Hood resumed mechanical clearing of juniper in old-field and other areas not occupied by golden-cheeked warblers. These control efforts were focused on juniper removal on West Maneuver Training Areas and resulted in clearing juniper from approximately 14,500 ha (35,830 ac) from old fields and other non-endangered species habitat areas. All control efforts and contracts were coordinated through the Fort Hood NRMB to avoid impact on endangered species habitats. Control efforts were not allowed within a 100-m (328-ft) buffer around endangered species habitats.



## Grazing

Cattle grazing is permitted on Fort Hood under a lease agreement with the Central Texas Cattlemen's Association. The current lease extension expired 15 September 2004. This lease provides grazing opportunities on 80,000 ha (197,684 ac) of Fort Hood land. A new lease went into effect on 1 April 2005. Under the new agreement, stocking rates will be driven by the results of annual forage inventories. Grazing is deferred or stocking rate is reduced where forage production fails to meet thresholds that allow for training impacts and land management practices such as prescribed burning. The lease agreement requires the lessee not to impact endangered species, historical, archaeological, architectural, or other cultural features on the installation, and requires compliance with local, state, and federal water pollution regulations. A supplemental Environmental Assessment (SEA) and "Finding of No Significant Impact" for the Fort Hood grazing program were issued in January 2004. On 22 February 2004, an additional supporting document titled "Points of Agreement Regarding Methodology for Calculating Animal Units for Grazing at Fort Hood, Texas" was signed by representatives from the Army, Fort Hood, and the Texas Department of Agriculture. The methodologies outlined in this agreement will be used to determine the cattle stocking rate on Fort Hood based on available forage as discussed above, thus providing an adaptive management feature that will assist in minimizing impacts to listed species.

## Cowbird Control Program

Fort Hood conducts extensive operations to reduce numbers of brown-headed cowbirds (*Molothrus ater*) on the installation. The objective of the control program is to maintain the incidence of cowbird parasitism of black-capped vireo nests below 10 percent annually, averaged over five-year periods. This program implements trapping and shooting activities that target feeding concentrations of cowbirds throughout the installation and cowbird individuals in endangered species nesting habitat. Summers and Norman (2004) provide details on the current implementation of the control program. In 2004, over 2,700 female brown-headed cowbirds were removed on Fort Hood during the warbler/vireo nesting season. Incidence of cowbird parasitism on black-capped vireo nests on Fort Hood in 2005 was 8.0 percent.

## Recreation

The post is open to public hunting and fishing. Access is regulated by the Range Control Division, Area Access Office, with the cooperation of Morale, Welfare, and Recreation (MWR) and the Natural Resources Management Branch. Over 80,500 ha (198,920 ac) are managed for fish and wildlife, including 100 surface ha (247 surface ac) of lakes and ponds, 88 km (55 mi) of rivers and permanent streams, and 85 km (53 mi) of shoreline access to Belton Lake. In recent years, the installation has provided 90,000 fisherman-days and 45,000 hunter-days annually. White-tailed deer, wild turkey, migratory waterfowl, northern bobwhite, and mourning dove are hunted during restricted seasons. Deer and turkey hunts are carefully controlled. Small-game hunting with shotgun is available in accordance with State of Texas seasons and bag limits.

Various low-impact outdoor recreation activities take place at the Belton Lake Outdoor Recreation Area located adjacent to TA 36. These include a swimming beach, camping, boating, trail bicycling, and cottage use. Boy Scout Camps are located in TA 36 and LTA 203. Hiking and nature observation activities are also allowed on many parts of the installation and are coordinated through Range Control Division. Mountain bike riding is restricted to a designated trail system at Belton Lake Outdoor Recreation Area. No off-road recreational vehicle use is permitted anywhere on the installation.

### 3 Species Accounts and Current Status on Fort Hood

#### Golden-cheeked Warbler

##### Nomenclature and Classification

**Scientific Name:** *Dendroica chrysoparia*

**Family:** Emberizidae

**Original Description:** Sclater and Salvin 1860

**Type Specimen:** Adult female collected by Osbert Salvin near Tactic, Vera Paz, Guatemala, on 4 November 1859. Specimen in the British Museum 1885-3-8-262.

**Current Federal Status:** Endangered (55 FR 53153-53160 [27 December 1990]).

**Past Federal Status:** Emergency listing as Endangered (55 FR 18844-18845 [4 May 1990]); Category 2 (47 FR 58454 [30 December 1982], 50 FR 37958 [18 September 1985], 54 FR 554 [6 January 1989]).

##### History of the Taxon

The name of this species has not changed since the original description of a specimen collected in Guatemala (Sclater and Salvin 1860). The first U.S. specimen was collected by D.C. Ogden in Bexar County, Texas (Dresser 1865). The species may have originated as part of a superspecies complex including the black-throated green warbler, the Townsend's warbler, and the hermit warbler (Mengel 1964, Lytle 1994). The definitive and only major bioecological study of the golden-cheeked warbler was completed by Pulich (1976). Sections of this study have been updated in Ladd and Gass (1999).

Because of rapid urban development, there is considerable interest in the status of the species in the Austin–San Antonio corridor. The Army is conducting studies of the species on Fort Hood, Texas, and the Camp Bullis Training Site of Fort Sam Houston, Texas.

**FORT HOOD:** Monitoring and research activities for the golden-cheeked warbler on Fort Hood were initiated in 1991 and continue through the pre-

sent. Current and past research and conservation efforts include point count surveys to determine population trends, demographic and reproductive monitoring in selected study sites, research in habitat selection, studies to determine the effects of habitat fragmentation and wildfire on golden-cheeked warbler demographics, and population viability analyses.

### **Description**

The golden-cheeked warbler is a small, strikingly colored songbird - approximately 13 cm in length, and 9 to 10 grams in weight. Detailed descriptions can be found in Pulich (1976), Oberholser (1974), and Ladd and Gass (1999). Adult males exhibit bright yellow cheeks outlined in black, with a black line through the eye. The upper parts, throat, neck, and upper breast are black with additional black streaking along the flanks. The wings are black except for two distinct white bars. The black tail is interrupted with white on the three outermost feathers. Adult female plumage is duller than that of the male, with a black-streaked olive back, a yellowish throat, and a blackish upper breast. The cheeks of female and immature birds are not as bright as those of the male. The back of immature birds also is streaked with green. Immatures often cannot be sexed based on plumage characteristics.

**FORT HOOD:** Plumage characteristics are consistent with those within the range.

### **Geographic Distribution**

The golden-cheeked warbler is the only North American bird species whose breeding range is restricted to a single state (Texas). Its nesting range is confined to 33 counties in central Texas. Historically, it has been recorded in 41 of the 254 counties in Texas. It is a species characteristic of the Hill Country of central Texas, inhabiting mature juniper-oak woodlands of the Edward's Plateau. The range of the golden-cheeked warbler corresponds closely with that of Ashe juniper (Pulich 1976).

Based on an extensive review of existing records, Pulich (1976) concluded that the species winters in mountainous areas (between 1,400 and 2,000 m; Thompson 1995) of east-central Guatemala through Honduras to Nicaragua, but that the exact winter range was not yet well defined. The presence of wintering birds in Mexico was considered questionable. However,

more recent evidence suggests that the species may winter in the state of Chiapas in extreme southern Mexico (Braun et al. 1986, Johnson et al. 1988, Perrigo et al. 1990, Vidal et al. 1994).

**FORT HOOD:** Known distribution of potential warbler habitat on Fort Hood is based on visual interpretation of aerial photography and ground surveys (Fig. 2). Currently, it is estimated that approximately 21,422 ha (52,935 ac) of suitable golden-cheeked warbler habitat occur on Fort Hood (Hayden et al. 2001). Warbler occurrence is widespread and has been documented in all training areas with suitable habitat on the installation.

### Migration

The golden-cheeked warbler is a migratory species that arrives early on its breeding grounds in Texas. The earliest spring arrival known to Pulich (1976) was a 2 March arrival in Austin in 1956. It is not certain whether male warblers arrive earlier than females. The mean spring arrival date for Bexar, Dallas, Kerr, and Travis Counties was between 12 and 16 March.

The species begins post-breeding migration rather early, with some birds headed toward their wintering grounds as early as mid-June (Pulich 1976). The main portion of the population leaves the breeding grounds by the end of July (Ladd and Gass 1999). The earliest fall record in southern Mexico was 5 August (Ladd and Gass 1999).

**FORT HOOD:** The earliest documented spring arrival on Fort Hood is 2 March. Peak arrival period is between 15 and 25 March. Similar to other populations throughout the range, most warblers on Fort Hood begin migration by the end of July.

### Habitat

**General:** The USFWS recovery plan provides a general overview of warbler habitat requirements (USFWS 1992). Golden-cheeked warbler habitat includes Ashe juniper and a variety of oak species. Several other hardwood species also occur (Pulich 1976). Fifteen stands sampled by Wahl et al. (1990) were dominated by Ashe juniper and Texas oak. Other important tree species included live oak, cedar elm (*Ulmus crassifolia*), Lacey oak (*Quercus laceyi*), Arizona walnut (*Juglans major*), post oak (*Quercus stellata*), and bigtooth maple (*Acer grandidentatum*). Studies by Johnston et

al. (1952) and Huss (1954) reported juniper–oak stands occupied by the golden-cheeked warbler with juniper composition of 14 to 50 percent and hardwood composition of 20 to 70 percent. For good warbler habitat at Meridian State Recreation Area, Kroll (1980) reported 52 percent Ashe juniper, 33 percent shin oak (*Quercus sinuate* var. *breviloba*), and 5 percent Texas oak. Similarly, the most important species in warbler habitat at Kerr Wildlife Management Area were Ashe juniper, Texas oak, and shin oak (Ladd 1985). While Ashe juniper is the dominant woody species throughout the warbler range, the composition of oak species varies geographically (Ladd 1985, Ladd and Gass 1999).

Pulich (1976) suggested that the golden-cheeked warbler requires woodland habitat with junipers averaging 50 years of age and 20 feet in height with some deciduous cover. Kroll (1980) quantified habitat of the species at Meridian State Recreation Area and found that 86 percent of the junipers within the study area were less than 50 years old (average  $40.8 \pm 29.4$  years). Good habitat that was consistently occupied from year to year differed significantly from unoccupied areas. Good habitat was characterized by older Ashe juniper (mean of 47.4 versus 25.6 years of age in good vs. poor habitat) but a greater variability in age, greater distance between trees, and a smaller juniper:oak density ratio (1.35 vs. 2.77). The warbler appears to be attracted to more mesic areas within the juniper–oak complex, such as canyons and seepy hillsides where deciduous hardwood vegetation is more abundant (Diamond, personal communication). Recent observations indicate warblers will reoccupy second growth areas (Ladd, personal communication; Diamond, personal communication) presumably in areas that have the appropriate mixture of juniper and deciduous oaks. Arnold et al. (1996) reported that 23 ha may be the minimum threshold size of habitat in which golden-cheeked warblers can produce young. Coldren (1998) found that golden-cheeked warblers select for habitat patches > 100 ha.

**FORT HOOD:** Warblers on Fort Hood occupy similar habitat to that described above.

**Nest Sites:** Chapman (1968) reported that the favorite nesting areas of the golden-cheeked warbler were “isolated patches or clumps of scrubby cedar, with scant foliage on the summits of the scarped canyon slopes and in the thick cedar ‘brakes’.” Nests are placed in juniper trees and a variety

of hardwood tree species (Chapman 1968, Pulich 1976). Nest height varies from 1.8 to 6.5 m, averaging 4.6 m (Brewster 1879, Chapman 1968, Pulich 1976). Nests average 8 cm in external width and 5 cm in external depth. They are composed mostly of bark collected in strips from juniper trees. Kroll (1980) estimated that juniper bark does not start to peel sufficiently for warblers to collect until juniper trees are about 20 years of age.

**FORT HOOD:** Nests have been found in Ashe juniper, Texas red oak, post oak, Texas ash (*Fraxinus texensis*), shin oak, blackjack oak (*Quercus marilandica*), slippery elm (*Ulmus rubra*), cedar elm, hackberry (*Celtis laevigata*), and Plateau live oak trees. Nest heights ranged from 2.0 m to 14.7 m, with an average height of 5.2 m (R. Peak, personal communication).

**Foraging Site:** The golden-cheeked warbler forages for insects in tree canopies (Smith 1916, Simmons 1924, Pulich 1976). Essential foraging habitat is provided by oak species within the habitats occupied (Kroll 1980, Ladd 1985, Wahl et al. 1990). Beardmore (1994) reported that oaks were used out of proportion to availability during April, but in proportion to availability during May and June. Fifty-seven percent of the foraging observations made by Kroll (1980) found warblers in oaks. Beardmore (1994) also reported foraging differences between male and female golden-cheeked warblers.

**FORT HOOD:** No data are available on foraging preferences on Fort Hood although foraging behavior is likely similar to that observed in other parts of the warbler's range.

### **Food Resources**

The golden-cheeked warbler is considered a generalist, consuming a wide variety of arthropods including Lepidopterans, Coleopterans, Hemipterans, Homopterans, Hymenopterans, Dipterans, Psocopterans, and Arachnids (Pulich 1976, Wharton et al. 1996). Kroll (1980) observed that most prey items used by the warbler were of Lepidopteran larvae (54 percent) and Orthopterans (13 percent).

**FORT HOOD:** No data are available on food resources on Fort Hood although food resources are likely similar to that observed in other parts of the warbler's range.

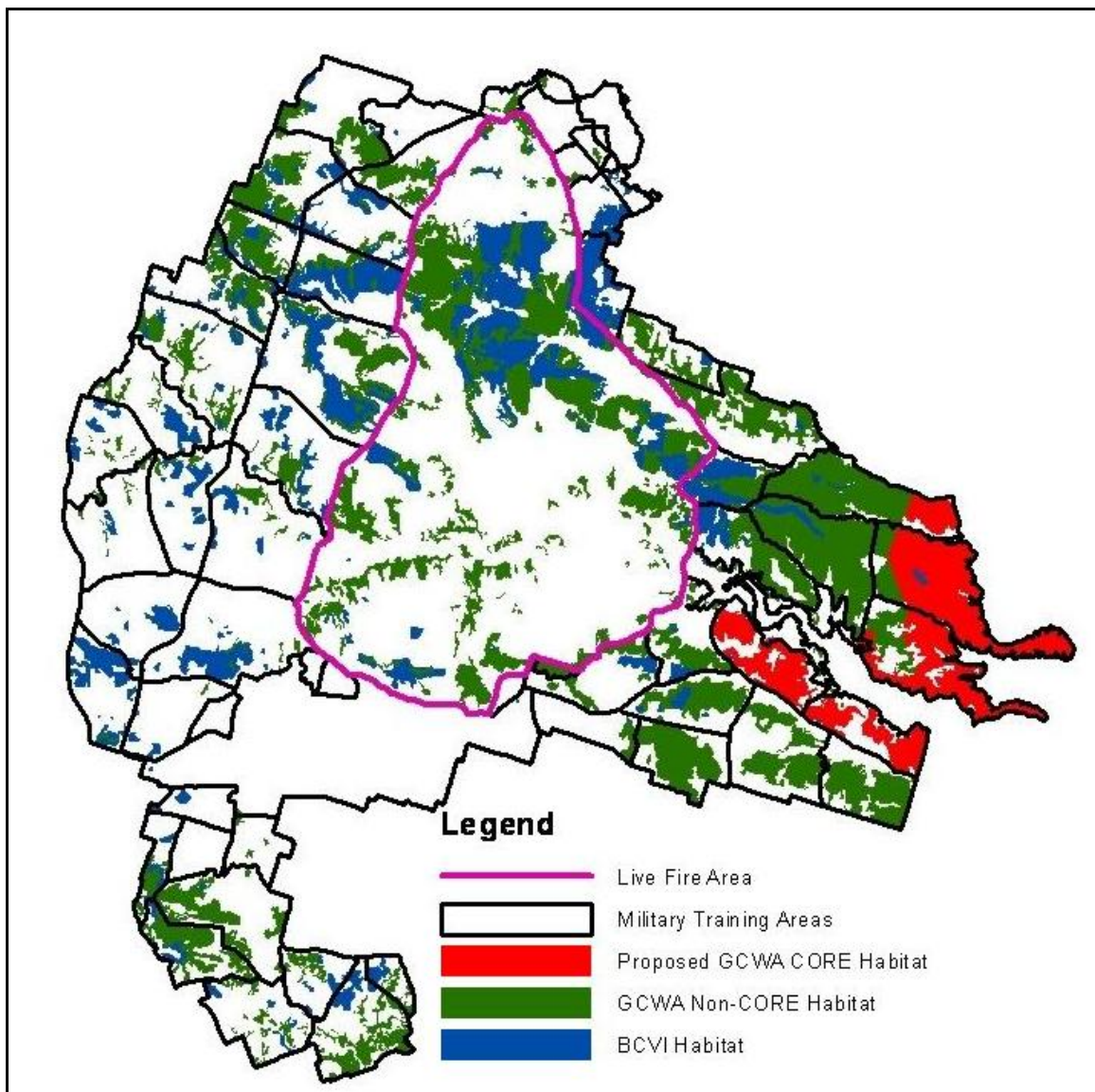


Figure 2. Golden-cheeked warbler and black-capped vireo habitats on Fort Hood, Texas.

### Population Estimates

Pulich (1976) estimated that the breeding population of the warbler in 1962 and 1974 was between 15,000 and 17,000 birds. Wahl et al. (1990) estimated a range of 4,822 to 16,016 individuals in 1989. The two estimates are not directly comparable, because they were derived in different ways (Wahl et al. 1990). Also, Wahl et al.'s (1990) estimate may be inflated since not all males are mated and all available habitat may not be fully occupied at the assumed average density of 15 pair per 100 ha.



Population estimates were derived from estimates of habitat availability and population density. Most studies report golden-cheeked warbler territory sizes ranging from 1.9 to 4.3 ha per pair (Ladd 1985). Wahl et al. (1990) reported density estimates of zero to 62.5 males per 100 ha with a median of 15 per 100 ha for several sites throughout the golden-cheeked warbler's range. Pulich (1976) classified warbler habitat into excellent, average, and marginal corresponding to 12.3, 5.0, and 2.9 pair per 100 ha.

**FORT HOOD:** Between 1992 and 2005 the mean number of golden-cheeked warblers reported on point count transects increased (Fig. 3). The 2005 mean number of detections/point was 1.154 (Peak 2005a).

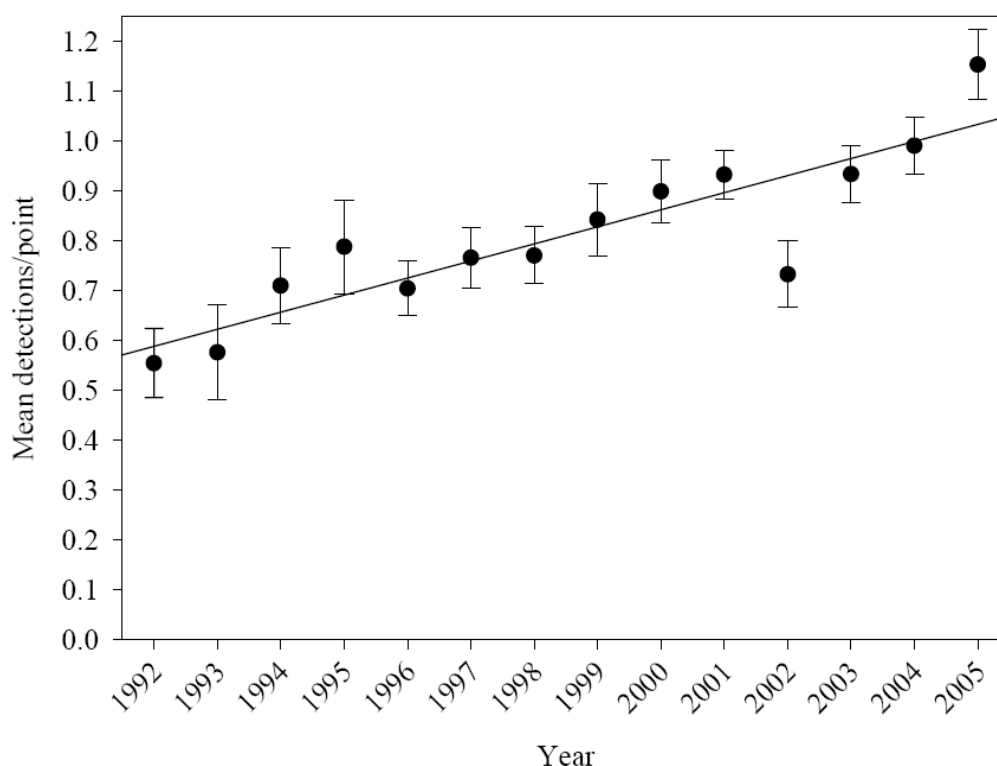


Figure 3. Mean detections/point/year of the golden-cheeked warbler increased during 1992–2005 on Fort Hood Military Reservation, Texas, USA (Peak 2005b).

Currently, it is estimated that approximately 21,422 ha (53,935 ac) of suitable golden-cheeked warbler habitat occurs on Fort Hood (Fig. 2). Using golden-cheeked warbler densities from intensively studied areas, the population on Fort Hood is estimated to range from 2,901 to 6,040 singing males. Observed density in 2005 on intensive study plots was 0.24 males/

ha (Peak 2005b), which, extrapolated to all available habitats, would produce an estimate of 5,141 territorial males.

### Survival and Dispersal

One-year banding returns reported by Pulich (1976) were 44.8 percent for males and 22.2 percent for females. USFWS (1996a) estimated 30 percent juvenile and 57 percent adult annual survival.

**FORT HOOD:** USFWS estimates of juvenile and adult survival were based on mark–recapture analysis of Fort Hood banding return data (USFWS 1996a). In the intensive study area in TA 13B, one-year banding returns of adult males ranged from 30 percent (15 of 50 males) in 1996 to 65.6 percent (21 of 32 males) in 1995, averaging 48 percent (61 of 127) for the period 1992–96 (Jette et al. 1998). Return rates of adult males during 2000–2005 (Fig. 4) ranged from 23.5 percent in 2005 to 50 percent in 2001 (Peak 2005b).

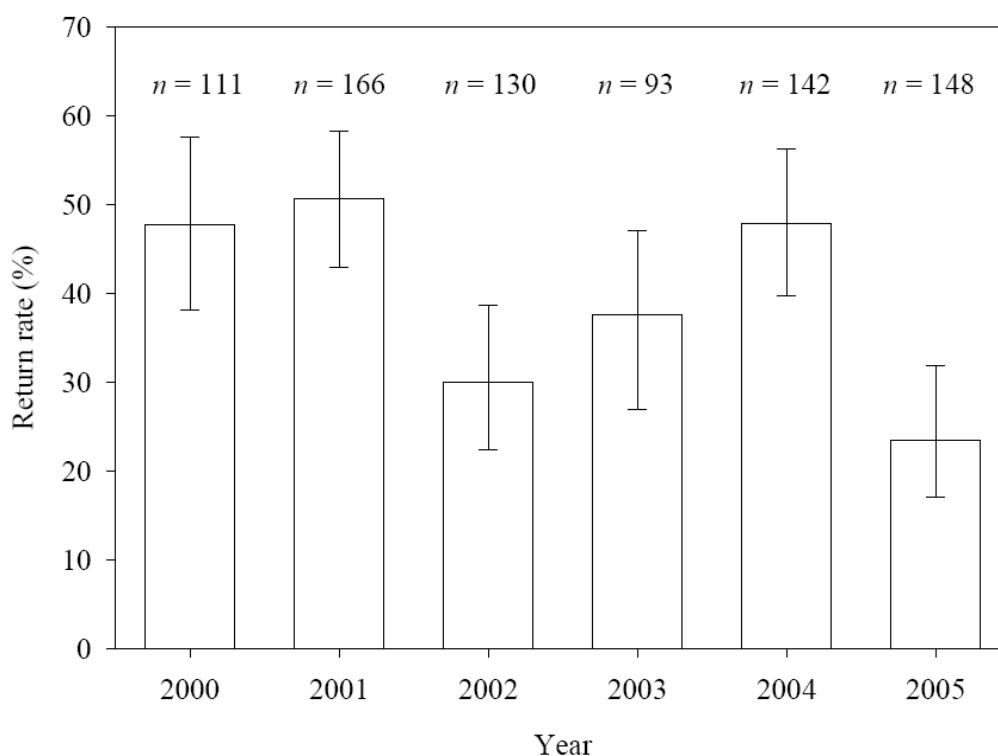


Figure 4. Return rate of male golden-cheeked warblers (mean  $\pm$  95% confidence interval) differed among 2000–2005 on Fort Hood (Peak 2005b).

## Reproductive Biology

The golden-cheeked warbler is sexually monogamous. Individual pairs establish exclusive breeding territories within which they nest and forage. The nesting cycle is as follows: construction (4–5 days), inactive construction (3–4 days), laying (4 days), incubation (11–12 days), nestling (9 days), fledgling feeding (28–45 days). Some nest construction may be initiated during late March, but most occurs during early April (Pulich 1976). Clutches typically consist of four eggs, sometimes three, and rarely five. The species is not commonly double-brooded, although pairs will renest after a failed nesting attempt.

The female performs most of the nesting duties (Pulich 1976). While males assist in feeding young during the nestling stage, they do not brood the young.

Of the 33 nests observed by Pulich (1976), 58 percent were parasitized by brown-headed cowbirds (cowbirds hereafter). Of the 55 eggs laid, 55 percent were lost or deserted due to cowbirds. Twenty-seven percent of the eggs laid fledged young.

**FORT HOOD:** Nest success was 60.8 percent in 2005 and did differ among years, 2000–2005 (Fig. 4, Peak 2005b). Pairing success was 88.5 percent in 2005 and did not differ among years, 2000–2005 (Fig. 5, Peak 2005b). During 1992–96, observed mating success ranged from 79 to 94 percent, with overall average mating success of 89 percent for adult males (Jette et al. 1998). A total of 315 warbler nests was found on Fort Hood between 1991 and 2005. Golden-cheeked warbler young fledged from 210 nests. Cowbird parasitism of golden-cheeked warbler nests has been observed on Fort Hood. In 60 nests in 2005 where clutches were initiated there was no evidence of nest parasitism by brown-headed cowbirds (Peak 2005b). Cowbird parasitism of golden-cheeked warblers on Fort Hood has been documented in other years but incidence appears low (Hayden et al. 2001).

## Interactions with Other Species

**Habitat Associates:** Other breeding birds found in association with the golden-cheeked warbler throughout most of its range include the black-and-white warbler, mourning dove, yellow-billed cuckoo, greater road-

runner, eastern screech owl, great-horned owl, barred owl, American crow, red-tailed hawk, red-shouldered hawk, common grackle, blue jay, western scrub jay, cliff swallow, chuckwill's widow, Carolina chickadee, Bewick's wren, Carolina wren, canyon wren, northern flicker, downy woodpecker, tufted titmouse, blue-gray gnatcatcher, white-eyed vireo, brown-headed cowbird, summer tanager, northern cardinal, painted bunting, and lark sparrow (Pulich 1976, Arnold et al. 1996, Jette personal communication).

Arnold et al. (1996) reported that, of the 23 predators and parasites found in association with the golden-cheeked warbler, only the brown-headed cowbird, greater roadrunner, and red-tailed hawk were found more frequently with warblers than without.

**FORT HOOD:** Similar habitat associates are observed on Fort Hood.

**Competition:** There probably is little competition from others of the same family as the golden-cheeked warbler occupies such a narrow ecological range (Pulich 1976).

**FORT HOOD:** Aggressive interactions are observed between closely related black-throated green warblers and golden-cheeked warblers on Fort Hood during migration. Black-throated green warblers are not resident breeders in Texas. No aggressive interactions have been observed with other species.

**Depredation:** Direct depredation on adults has not been observed frequently. However, nests are depredated by snakes, grackles, jays, and possibly squirrels (Pulich 1976, Pease and Gingerich 1989). Red fire ants are a potential problem (Pulich 1976).

**FORT HOOD:** Stake et al. (2004) monitored 67 golden-cheeked warbler (*Dendroica chrysoparia*) nests with infrared video cameras and time-lapse recorders to identify predators. Rat snakes (*Elaphe* spp.) were the most frequent predators, depredating 12 nests and capturing three adult females. A variety of avian predators depredated seven nests, including three American crows (*Corvus brachyrhynchos*), two brown-headed cowbirds (*Molothrus ater*), one western scrub jay (*Aphelocoma californica*), and one Coopers hawk (*Accipiter cooperii*). Fox squirrels (*Sciurus niger*) depredated four nests and were the only mammalian predators recorded.

Post-outcome recordings (i.e., after young fledged or nests failed) revealed western coachwhips (*Masticophis flagellum testaceus*), mice (*Peromyscus* sp.), and Greater roadrunners (*Geococcyx californianus*) as potential predators, though they were not recorded at active nests.

**Parasites:** Pulich (1976) observed no mites or ectoparasites in golden-cheeked warbler nests.

**FORT HOOD:** Small white mites have been observed on the rectrices of adult warblers during banding. No other data are available on parasites of warblers on Fort Hood.

### Threats to Survival

Threats to golden-cheeked warbler identified in the 1994 Recovery Plan (USFWS 1992) included breeding habitat loss, loss of winter and migration habitat, habitat fragmentation, nest parasitism by cowbirds, and destruction of oaks. A more recent population viability and habitat assessment (USFWS 1996a) also identifies concerns related to reservoir development, oak wilt, predation, and secondary effects of urbanization in proximity to warbler habitats.

Habitat loss is attributed to urban development and clearing associated with agricultural practices. Pulich (1976) estimated a juniper eradication program for range improvement reduced juniper acreage in Texas by 50 percent between 1950 and 1970. Wahl et al. (1990) reported warbler breeding habitat loss of approximately 4 percent per year over a 10-year period in urbanizing areas and about 2 to 3 percent per year in rural areas during the past 20 years. This work was based on satellite imagery from 1974 through 1981. More recent satellite imagery may show that the rate of habitat loss has increased in recent years (Grzybowski et al. 1990). Estimates of loss of wintering habitat in Central America (two to four percent per year) are similar to estimated losses of breeding habitat (Jahrsdoerfer 1990, Lyons 1990).

Loss of habitat has resulted in increased fragmentation of warbler habitat. Wahl et al. (1990) estimated a 53- to 84-percent reduction in suitable habitat (> 50 ha in size) due to habitat fragmentation around urban areas and a 56- to 89-percent reduction in rural areas. Habitat fragmentation has been suggested as a cause of population declines in other songbird

species (Gates and Gysel 1978, Brittingham and Temple 1983, Wilcove 1985, Andren and Angelstrom 1988, Pease and Gingerich 1989). However, habitat fragmentation may make warblers more susceptible to depredation by blue jays in urban areas (Engels and Sexton 1994) and more susceptible to nest parasitism by cowbirds (Brittingham and Temple 1983, Robbins et al. 1989, Thompson 1994). Coldren (1998) found that golden-cheeked warblers selected for habitat patches > 100 ha and that territory placement selected against urban land uses including commercial development, entertainment, forested non-warbler habitat, high-density transportation, and utilities.

Cowbird parasitism reduces productivity in host species (Brittingham and Temple 1983). Golden-cheeked warblers are susceptible to cowbird parasitism (Pulich 1976). Land use practices that increase the incidence of cowbird parasitism such as habitat fragmentation, cattle grazing, and increased urbanization may limit productivity in golden-cheeked warblers.

Oaks are a necessary component of warbler habitat. Loss of oaks in warbler habitat is attributed to disease (oak wilt fungus, *Ceratocystis* spp.) and overbrowsing by white-tailed deer, goats, and various exotic ungulates.

**FORT HOOD:** There has been no evidence to date of overbrowsing of oaks on Fort Hood (J. Cornelius, pers. comm.). Incidence of oak wilt fungus has been observed on Fort Hood and its further spread is being monitored and treated. Studies on Fort Hood to determine the efficacy of basal girdling to control spread of oak wilt were conducted in 2004 and 2005 (Reemts et al. 2005). Treated plots had a lower incidence of new infections compared with control plots. While there have been no juniper eradication contracts in warbler habitats on Fort Hood since 1990, junipers are cleared from old fields that are not suitable as warbler habitat. The only significant loss of warbler habitat comes from fires. Warbler habitat is not altered significantly by military training since vehicle transit is limited through the dense vegetative growth typical of warbler habitat. Maas-Burleigh (1997) reported that golden-cheeked warbler males in more fragmented landscapes on Fort Hood reproduced less often than males in contiguous forest.

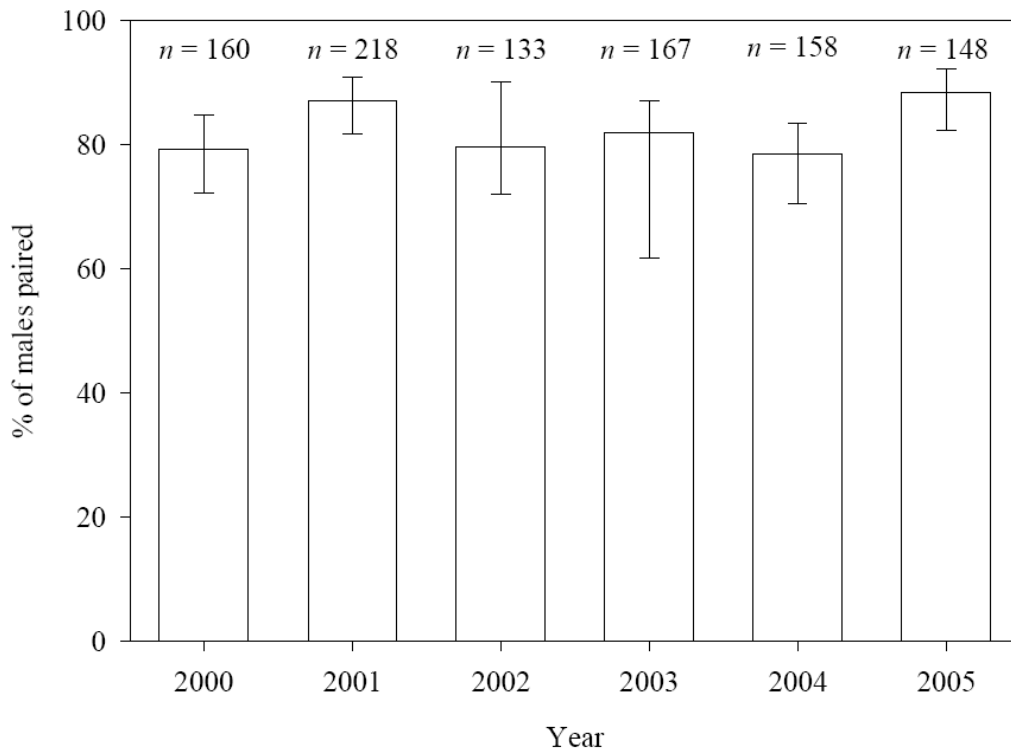


Figure 5. Pairing success for territorial male golden-cheeked warblers (mean  $\pm$  95% confidence interval) did not differ among 2000–2005 on Fort Hood (Peak 2005b).

## Black-capped Vireo

### Nomenclature and Classification

**Scientific Name:** *Vireo atricapilla* Woodhouse

**Family:** Vireonidae

**Original Description:** Woodhouse 1852

**Type Specimen:** Adult male collected by S. W. Woodhouse on 26 May 1851 at the San Pedro River 10 miles from its source—Devil’s River, near Sonora, Sutton County, Texas (Deignan 1961). Deposited in the National Museum of Natural History, number 15040.

**Current Federal Status:** Endangered (52 FR 37420-37423 [6 October 1987]).

**Past Federal Status:** Category 2 (47 FR 58454 [30 December 1982]); Category 1 (50 FR 37958 [18 September 1985]).

## History of the Taxon

Grzybowski (1995) provides a recent account of this species. The species was first described by Woodhouse (1852). Until recently, there were few major studies of the black-capped vireo. Bunker (1910) first studied nesting, stomach contents, and plumage of the vireo in Blaine County, Oklahoma. In another study, Graber (1957, 1961) examined distribution, ecology, and population biology of the species. Marshall et al. (1985) wrote a profile of the species, focusing on the distribution and abundance in the United States and Mexico. Grzybowski has continued studies on the species in parts of Texas and Oklahoma, and authored the species Recovery Plan (USFWS 1991) and the species account for the Birds of North America publication (Grzybowski 1995). Tazik (1991) initiated research on one of the largest concentrations of nesting black-capped vireos north of Mexico, on Fort Hood, Texas. Recent research efforts include a study of alternative host densities and the incidence of cowbird parasitism in black-capped vireos by Barber and Martin (1997), the effects of prescribed burning on black-capped vireo habitat and vireo nesting dynamics by O'Neal et al. (1996), and a population estimate for the breeding population in Mexico by Benson and Benson (1990). Army-sponsored studies are ongoing at Fort Hood, Texas; Camp Bullis Training Site, Texas; Fort Sam Houston, Texas; and Fort Sill, Oklahoma. Other monitoring and research activities are conducted on other local, state, and Federal properties in Texas.

**FORT HOOD:** Research and conservation efforts on Fort Hood have included an inventory and monitoring program, remote camera studies of nest depredation and assessment of training activities in endangered species habitats, a habitat restoration program, a study of researcher activities on nesting vireos, a nest site/habitat analysis, assessment of cowbird movements and activity, and a cowbird parasitism control program.

## Description

The black-capped vireo is a small songbird approximately 11 cm in length and 10 grams in weight. The sexes are dimorphic. On the adult male, the crown and upper half of the head is black and sharply demarcated. Black extends farther posterior on older males. The back is olive-green and undersides are white with olive-yellow flanks. Wings have olive-yellow-black plumage colors with two light-yellowish wing bars. The adult female is similar in color except for a gray crown, often with some black around



the white eye mask, and underparts washed with greenish yellow. Adults have a red to reddish-brown iris. Immature birds are browner above, and buffy below (Grzybowski 1995).

**FORT HOOD:** Black-capped vireos on Fort Hood are similar in appearance to the description above.

### **Geographic Distribution**

The breeding range of the black-capped vireo formerly stretched from south-central Kansas through central Oklahoma and central Texas into central Coahuila, Mexico, and possibly Nuevo Leon and Tamaulipas (Graber 1961, American Ornithologists' Union 1983). The northern extent of the range has contracted significantly over the past half-century (Grzybowski 1995, Grzybowski et al. 1986). The species has not been observed in Kansas since the late 1950s (Tordoff 1956, Graber 1961) and reaches its northern limit in Blaine County, Oklahoma (Grzybowski et al. 1986). The vireo appears to be gravely endangered in Oklahoma (Grzybowski et al. 1986, Grzybowski 1987, Ratzlaff 1987) and is declining in many areas of Texas (Grzybowski 1995, USFWS 1991). Black-capped vireos have been reported in at least 40 counties in Texas (Beardmore and Hatfield 1995).

**FORT HOOD:** A single black-capped vireo vocalization was reported in a 1979 baseline ecological report for Fort Hood. Vireos were subsequently observed in 1985 by John Cornelius, a biologist with the NRMB at Fort Hood. These initial findings comprised a small number of birds (Tazik et al. 1993a). Inventory, monitoring, and research efforts were initiated in 1987 and continue through the present. Current known vireo habitat on Fort Hood is shown in Fig. 2. Vireos are known to exist elsewhere on the installation, but are typically isolated territories within habitat shown in Fig. 2 as golden-cheeked warbler habitat.

### **Migration**

The black-capped vireo is migratory and is known to winter along the western coast of Mexico from Sonora to Oaxaca (Graber 1961). Although extensive winter surveys have not been done, most observations have been recorded in Sinaloa and Nayarit (Grzybowski 1995). Vireos first arrive on Texas breeding areas during late March to mid-April, and in Oklahoma during mid-April to early May (U.S. Fish and Wildlife Service 1991). Fall

migration takes place during August and September. Graber (1961) reported that young birds leave first, followed by adult females, and then adult males.

**FORT HOOD:** On Fort Hood, males typically are first observed in late March or early April. It is suspected that females arrive shortly thereafter. Many males are no longer strongly territorial by the end of July, although some have nested into August. Most black-capped vireos appear to have departed by mid-September.

### **Habitat**

**General:** The black-capped vireo is found in hardwood scrub habitat that typically exhibits a patchy or clumped distribution with a scattering of live and dead trees. Characteristic is the presence of hardwood foliage to ground level. Scrubby oaks are a major feature of the habitat. Blackjack oaks are dominant in Oklahoma. Shin oak, Texas oak, and live oak are the dominant oaks in vireo habitats in Texas (Graber 1961, Grzybowski 1986, Grzybowski et al. 1994). Dense juniper stands typically are avoided. In the eastern parts of the range, preferred habitat often results from fire within stands of mature, mixed oak–juniper woodlands and remains suitable for five to 25 years after fire. In the arid western portions of the range, shrub habitats occupied by the vireo represent climax conditions rather than early seral habitats (D. Diamond, personal communication). The best vireo habitats found by Marshall et al. (1985) were in 10- to 15-year-old burns that were hot enough to kill junipers. Data from some study sites indicated that there were significant differences with regard to the vegetation structure in territories held by first-year males compared to those held by older males (Grzybowski et al. 1994). First-year males tended to occupy areas that were more open floristically.

**FORT HOOD:** Black-capped vireo habitat at Fort Hood typically is shrubby, and ephemeral with a “clumped” vegetation structure. Most habitat patches were caused by accidental fires or mechanical clearing related to military training and operations. Sites are generally occupied by vireos from four to 25 years following disturbance. The most common tree/shrub species found in black-capped vireo habitat on Fort Hood were shin oak, flame-leaf sumac (*Rhus lanceolata*), Ashe juniper, Texas oak, skunkbush sumac (*Rhus trilobata*), Texas redbud (*Cercis canadensis* var. *texensis*), and Texas ash (Tazik et al. 1993b). Tree/shrub species composition on

vireo territories is variable, and that habitat structure (i.e., presence of low hardwood scrub) is a more critical factor in habitat selection than species composition (Tazik et al. 1993b).

Based on an installation-wide survey conducted in 2002 and 2003, the current estimate of suitable black-capped vireo habitat on Fort Hood is 6,967 ha (17,216 ac). Approximately 90 percent of suitable habitat is estimated to be occupied by black-capped vireos (Cimprich 2003).

**Nest Site:** The nest is open-cupped and pensile, about 5.8–6.2 cm in depth and 5.9 cm wide, and typically is located 0.5 to 1.5 meters above ground (Graber 1961). Nests consist largely of dried grass and leaves bound with spider web. Other materials may include plant fibers, cottony plant substances, paper, wool, and caterpillar silk. A variety of woody species common to the general habitat are used as nest substrates. As with the species composition of the general habitat, nest substrates vary geographically. Blackjack oak is the most frequently used species in Oklahoma while shin oak and Texas oak are frequently used in Texas (Graber 1961, Grzybowski 1986). Juniper and live oak are used but less than in proportion to availability (Grzybowski 1986).

**FORT HOOD:** Nest construction on Fort Hood is similar to that observed throughout the species' range. Mean nest height in 2005 was 0.83 m (Cimprich 2005). Nest substrates include shin oak, Texas red oak, Texas redbud, Ashe juniper, Texas ash, Plateau live oak, cedar elm, rusty blackhaw (*Viburnum rufidulum*), Mexican plum (*Prunus mexicana*), evergreen sumac (*Rhus virens*), elbow-bush (*Forestiera pubescens*), hackberry, Texas persimmon (*Diospyros texana*), skunkbush, Mexican buckeye (*Ungnadia speciosa*), Carolina buckthorn (*Frangula caroliniana*), and blackjack oak (Cimprich 2005).

**Foraging Sites:** The vireo is a foliage-gleaning insectivore that forages among the trees and shrubs in its habitat. It rarely feeds on the ground (Graber 1961). Foraging substrate preferences have not been quantified but may prefer deciduous substrates such as oaks (Grzybowski 1995).

**FORT HOOD:** Little is known of the foraging substrates at Fort Hood, but low hardwood vegetation appears to be used (Tazik et al. 1993b).

Vireos also have been observed foraging in taller junipers and oaks when tending fledglings.

### **Food Resources**

Graber (1961) quantified the stomach contents of 11 black-capped vireos. Insect larvae constitute the bulk of the diet. Lepidopteran larvae predominate followed by Coleopteran larvae. Other animal matter includes spiders, centipedes, Neuroptera, Odonata, Hemiptera, and Homoptera. The young are fed small larvae, with food items increasing in size as the young grow. Grasshoppers and other Orthopterans may contribute as much as one-third of their diet.

**FORT HOOD:** Dietary studies of the black-capped vireo have not been conducted at Fort Hood but diet is likely similar to that observed in other parts of the vireo's range.

### **Known Population**

The known population consists of populations in Oklahoma, Texas, and Mexico. Grzybowski (1995), in his review of the species, cites data collected from 1990 to 1994 and reports three populations in Oklahoma; one had 20–30+ adults, a second in which 150 breeding females were documented, and a third that consisted of a very small group of birds. He also cites reports of <150 adults in the Austin area of Texas (in 1989) and 450 adults in Kerr County, Texas (in 1990). Other sites in Texas contributed a count of 357 males at Fort Hood in 1997 (The Nature Conservancy 1998) and 12 males at Camp Bullis/Fort Sam Houston in 1997 (Weinberg 1998). The estimated population in Mexico is described in Benson and Benson (1990) and was based on 28 confirmed birds, which the authors extrapolated out to an estimate of 3,139–9,463 pairs. See Scott and Garton (1991) and Benson and Benson (1991) for comments and details regarding the methods for the estimate.

**FORT HOOD:** Distance sampling at 850 points yielded an estimate of 4,834–8,261 male black-capped vireos present on Fort Hood in 2005 outside of the Live-Fire Area (Cimprich 2005). No trends were detected in black-capped vireo abundance from 1998 through 2005 (Cimprich 2005).

### **Territory Size and Density**

Graber (1961) reported an average territory size of 1.5 ha. Mr. Jim O'Donnell reported an average territory size of about 3 ha in Travis County, Texas (in Marshall et al. 1985). Graber (1961) also reported that the smallest breeding population she ever found consisted of five males and three females.

**FORT HOOD:** At Fort Hood, Tazik and Cornelius (1993) reported an average territory size of 3.6 ha, ranging from 1.9 to 7.0 ha. Density estimate in 2005 was 0.51 males/ha in intensively monitored sites (Cimprich 2005). In contrast to Graber (1961), at Fort Hood there are regular observations of only one or two pairs at a given location. These isolated territories have been successful in fledging young.

### **Survival**

Graber (1961) found that 69 percent of the males that she banded returned the following year, but that only 41 percent of females returned. Grzybowski (1990) reported a similar difference between sexes; 65 percent for males versus 41 percent for females in main colony sites in Texas. One-year returns in the Wichita Mountains of Oklahoma were 62 percent for males and 44 percent for females (Grzybowski 1989a). The difference between sexes may be due to several factors: greater inconspicuousness of females compared to males, less site tenacity on the part of females, or a real difference in survivorship between the sexes. Lower survivorship among female songbirds has been reported by others (Nice 1937, Stewart and Aldrich 1951, Nolan 1978). Juvenile survivorship is at least 24 percent (Grzybowski 1995) but may be in the range of 35 to 55 percent (Grzybowski and Pease, personal communication). Grzybowski (1995) indicates that 96 percent of the males greater than one year old were site-faithful, while many yearling males exhibited less site tenacity and a greater degree of dispersal or wandering. Grzybowski (1990) found return rates in small "satellite" populations to be lower than those in main "colonies." This might be due to differences in site tenacity more so than differences in survivorship between the two population types.

**FORT HOOD:** Fort Hood estimated return rates of adult black-capped vireos in 2005 were 42 percent for males and 18 percent for females. In

general, these return rates of banded black-capped vireos to study areas have been consistent since 1997 (Fig. 6, Cimprich 2005).

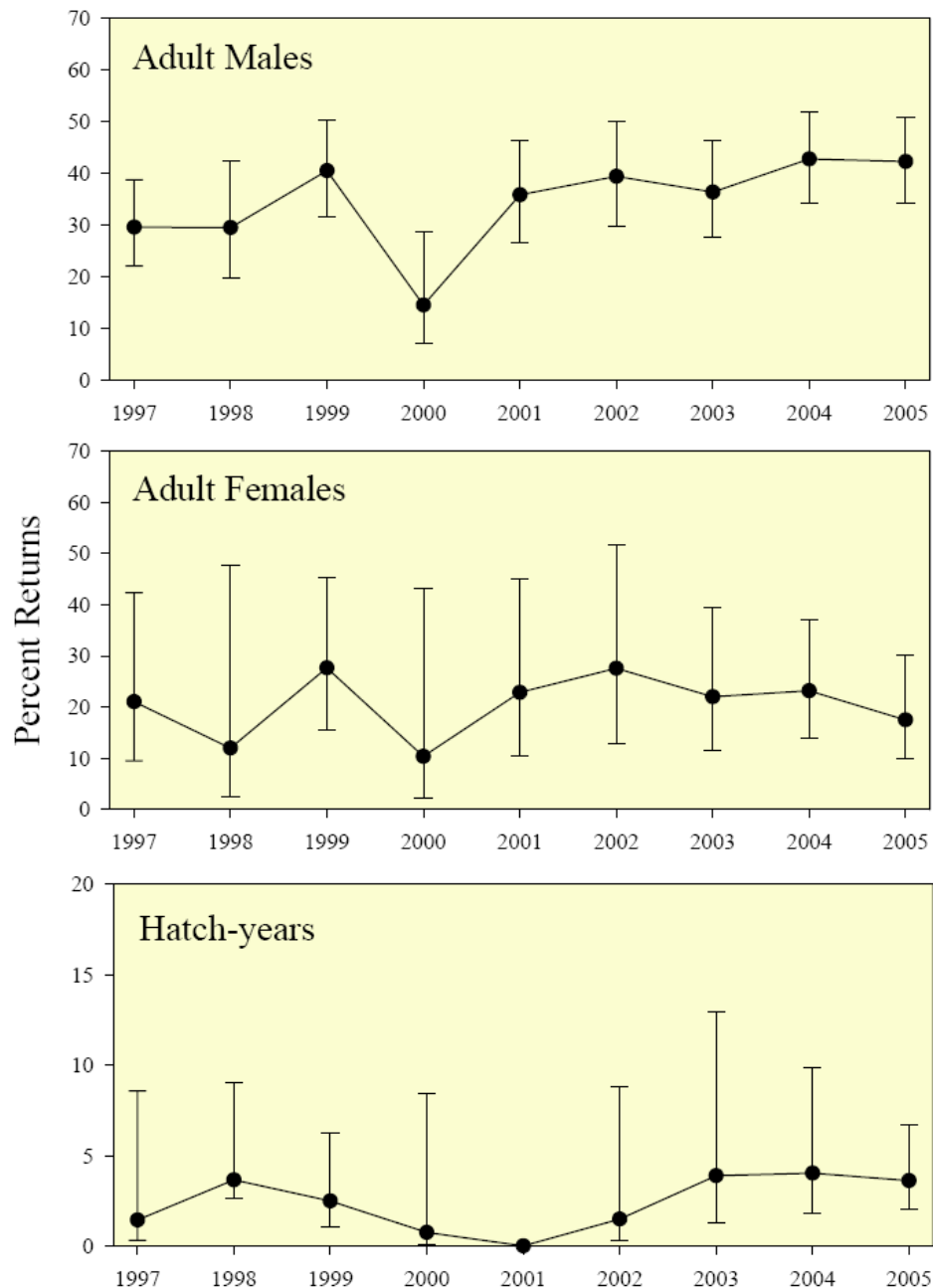


Figure 6. Return rates of banded black-capped vireos to study areas on Fort Hood, Texas, from 1997 to 2005. Each point represents the percentage of individuals present the previous year that were detected in the current year on the same study area. The vertical lines span 95% confidence intervals. Note that the y-axis scale on the graph representing hatch-year birds differs from the scale on the other two graphs (Cimprich 2005).

## Reproductive Biology

Within a breeding season, black-capped vireos are monogamous or sequentially polygamous (Grzybowski 1995). Individual pairs establish breeding territories. The nest cycle includes construction (4–5 days), inactive construction (1 day), laying (4 days), incubation (14–17 days beginning after the second or third egg laid), brooding of nestlings (11 days), and fledgling (40+ days) (Graber 1961). The male is involved in all stages of the nesting cycle. Both sexes participate in nest building, although the female performs more of the construction as the male often pauses to sing and defend the territory (Graber 1961). The male conducts about one-third of the incubation. Upon hatching, the chicks are brooded by the female while the male furnishes about 75 percent of the food for the young. Pairs frequently renest after both successful and unsuccessful nest attempts.

Reproductive success reportedly has been poor throughout the range of the vireo due largely to the impact of brown-headed cowbird brood parasitism (Graber 1961, Grzybowski 1995, Grzybowski et al. 1986, Grzybowski 1988, 1989b, 1990). In one example, Graber (1961) observed a sample of 76 nests containing a total of 243 eggs. Only 17.6 percent (43 eggs) produced fledglings. Of the 134 eggs lost prior to hatching, 72.3 percent were lost to cowbird activity. Only nine percent of eggs were lost to predators. Among the 95 eggs that hatched young, 26.3 percent were lost due to the presence of cowbird young in the nest, while 16.8 percent were lost to predators. In all, 19.7 percent (15 of 76) of nests in which eggs were laid and 59.7 percent of mated pairs (46 of 77) were successful in fledgling at least one vireo. A total of 43 young were fledged for an average production of 0.56 young per pair per year. In another example, Grzybowski (1990) reported production of 0.92 to 2.58 young per pair in areas with cowbird removal and zero to 0.38 young per pair in areas without cowbird removal during 1988. During 1989, production was 2.00 to 3.78 in removal areas compared to 1.27 to 1.44 in nonremoval areas. In Oklahoma, production was 1.37 with cowbird removal, 0.36 without removal (Grzybowski 1990). Other productivity reports include 0.82 to 1.76 on three areas managed by the Texas Parks and Wildlife Department (Bryan and Stuart 1990), and an average of 1.0 to 1.4 young per pair per year (with cowbird egg removal) at Fort Sill, Oklahoma, during the period 1988 through 1990.

**FORT HOOD:** At Fort Hood, black-capped vireos appear to be primarily monogamous; however, sequential polygamy has been commonly observed.

Nest parasitism by cowbirds has been severe at times on Fort Hood, particularly in the initial years of the monitoring program. Mitigation of that phenomenon has been an integral component of the management strategy and nest parasitism rates at Fort Hood have dropped dramatically. In 1987 and 1988 nest parasitism rates were about 90 percent. In 1993, 1994, and 1995 those rates dropped to 25.8, 12.8, and 15.2 percent, respectively. Mean parasitism rates in non-Live-Fire Areas were 6.3% during 2001–2004 (Summers and Norman 2004). The incidence of parasitism in 2005 was eight percent (Cimprich 2005). Nest success rates mirrored those trends. In 1987 and 1988, nest success rates were less than five percent, while they were between 32.7 and 55.6 percent during the period 1993–1995 (Weinberg et al. 1998). Cimprich (2002, 2003, 2004) reported a success rate of 61% in 2002, 38% in 2003, and 47% in 2004. Observed nest success in 2005 was 25 percent (Cimprich 2005). The increase in nest success was attributed to aggressive cowbird trapping and shooting efforts conducted by Fort Hood biologists. A strong negative correlation exists between the number of female cowbirds trapped during the black-capped vireo breeding season and the incidence of cowbird parasitism of black-capped vireo nests from 1987 to 2004.

In 2005, 40 percent of territorial males succeeded in producing  $\geq 1$  fledglings. Successful nests produced a mean of 3.22 fledglings, and territorial males produced an average of 1.13 fledglings over the entire season (Cimprich 2005). No trend in daily nest survival estimates has been found since 1997 (Cimprich 2005).

### **Interactions with Other Species**

**Habitat Associates:** The black-capped vireo co-exists with a wide variety of other species within its habitat. The particular composition of associated species differs somewhat geographically (Graber 1961).

**FORT HOOD:** Some characteristic associates of the black-capped vireo on Fort Hood include northern cardinal, tufted titmouse, blue-gray gnatcatcher, white-eyed vireo, northern mockingbird, yellow-breasted chat,



brown-headed cowbird, painted bunting, rufous-crowned sparrow, field sparrow, and Bewick's wren.

**Competition:** Territories of the black-capped vireo sometimes overlap with that of the white-eyed vireo or Bell's vireo. No direct competition with other species was observed by Graber (1961).

**FORT HOOD:** At Fort Hood, a black-capped vireo was observed chasing a white-eyed vireo (J. Cornelius, personal communication). In 2002, a white-eyed vireo initiated a clutch in a nest that was initially constructed by a black-capped vireo (T. Hayden, unpublished data).

**Depredation:** Direct depredation on adult birds has rarely been observed.

**FORT HOOD:** Stake and Cimprich (2003) monitored 142 black-capped vireo nests at Fort Hood, Texas, from 1998 to 2001 using time-lapse infra-red video cameras to identify nest predators. They recorded 59 predator visits (where at least some of the nest contents were removed or destroyed), resulting in 48 depredated nests. Snakes and fire ants (*Solenopsis* spp.) were the leading predators, accounting for 18 (38%) and 15 (31%), respectively, of all depredated nests. They also identified a variety of avian (19% of depredated nests) and mammalian predators (11% of depredated nests). Despite intensive brown-headed cowbird (*Molothrus ater*) removal at Fort Hood, nine predator visits by females of this species were recorded, but only one resulted in nest failure. Although predator visits occurred at all hours, most (58%) took place at night. The daily predation rate was higher during the nestling stage than during incubation, partly due to the apparent inability of fire ants to prey upon vireo eggs.

**DISEASE:** The species is unusually free of ectoparasites and disease (Graber 1961).

**FORT HOOD:** Studies of disease and ectoparasites have not been conducted on the black-capped vireo on Fort Hood.

### Threats to Survival

Major threats to the continued existence of the black-capped vireo include (1) loss of habitat due to urban development, excessive rangeland im-

provement, grazing by sheep, goats, and exotic herbivores, and natural succession including juniper invasion; and (2) cowbird brood parasitism (Grzybowski 1995, Shull 1986, Ratzlaff 1987). The black-capped vireo recovery plan (USFWS 1991) and the 1995 Population Viability and Habitat Analysis (PVHA) Workshop Report (USFWS 1996b) document regional threats to survival.

**FORT HOOD:** At Fort Hood, the primary threats to the black-capped vireo are brood parasitism, habitat loss and degradation, and fire suppression.

## Texabama Croton

No federally endangered or threatened plant species are known to occur on Fort Hood. The Alabama croton (*Croton alabamensis* var. *alabamensis*) is a species of concern that was formerly a category 2 candidate for federal listing. This species was formerly known from only two counties in Alabama and one county in Tennessee. In 1989 a variety of *C. alabamensis* was discovered on Fort Hood. This variety has subsequently been described and designated as *C. alabamensis* var. *texensis* (Ginzburg 1992). It is sometimes known by the unofficial common name of Texabama croton.

### Nomenclature and Classification

**Scientific Name:** *Croton alabamensis* var. *texensis*

**Family:** Euphorbiaceae

**Original Description:** Ginzburg 1992

**Type Specimen:** Gainer Ranch, Travis County, Texas, (Ginzburg 1992)

**Current Federal Status:** Species of Concern

### History of the Taxon

**Alabama:** *C. alabamensis* was first noticed by E.A. Smith in 1877 (McDaniel 1981), and has since been described as one of the rarest shrubs in the United States (Farmer and Thomas 1969). Habitat information and the original description were published in Mohr (1889). The Alabama variety of this taxon currently is listed as a category 2 candidate species for federal listing.

**Texas and Fort Hood:** In 1989, a disjunct population of this species was discovered on Fort Hood Military Reservation by John Cornelius, a Fort Hood installation wildlife biologist. Other Texas populations have subsequently been discovered in Travis and Coryell counties. After taxonomic review, the Texas population of this species was designated a new variety, *C. alabamensis* var. *texensis* (Ginzburg 1992).

### Description

**Texas and Fort Hood:** A technical description of the Texas variety of *C. alabamensis* is given in Ginzburg (1992). In most respects, the appearance of the Texas variety is very similar to the Alabama variety (described in Kral 1983). There are distinct differences in coloration of scales on the underside of the leaves and stems. The Texabama croton has copper-colored scale surfaces, and some scales have dark reddish-brown centers. In contrast, the Alabama variety has silver scale surfaces and scales lack dark centers.

The Texabama croton is a monoecious shrub 2–3 m tall with many branches emerging from the base. Lower branches sometimes take root and stems have thin gray bark, which gives a slightly sweet odor when scratched. Stems are leafy only near their tips and new growth is angular. Leaves are alternate, exstipulate; petioles 0.6–1.9 mm long, canaliculate; blades ovate or elliptic, 3.8–9.0 cm long, 1.5–4.0 cm wide, entire; apex acute, rounded or emarginate; base obtuse to slightly cordate, glandless; upper surface dark green with scattered scales. The inflorescence is a terminal 6–14 flowered raceme, 1.9–3.3 cm long with pistillate flowers near the base and staminate flowers above (Ginzburg 1992).

### Geographic Distribution and Known Population

**Alabama:** Prior to its discovery in Texas, *C. alabamensis* was known only from Tuscaloosa and Bibb Counties in Alabama and Coffee County in Tennessee (Ginzburg 1992). In Alabama, the species is restricted to two major population centers. Individual populations consist of a few to many individuals covering several acres (Kral 1983). At the time of Farmer's work (1962), the species covered no more than about 40 ha.

**Texas and Fort Hood:** The Texas variety has been observed in Bell, Coryell, and Travis Counties. In Travis County, the plants occur mostly in

deciduous forest in mesic limestone canyons and on slopes. The major known populations in Travis County are on the Gainer Ranch (500–1,000 plants) and the Penn Ranch (several thousand individuals) (Ginzburg 1992).

In Coryell County, the Texas variety is known only from Fort Hood. Both significant populations on Fort Hood occur in protected canyons along the Owl Creek river drainage in Land Groups 1 and 2 (Aplet et al. 1994). The largest population, consisting of several thousand individuals, occurs in Land Group 1 (Ginzburg 1992). Several scattered plants and a small population have been found between and around these two populations near tributaries to Owl Creek (Aplet et al. 1994). The total population on Fort Hood is estimated to be around 20,000 individuals (Aplet et al. 1994).

### **Habitat**

**Alabama:** There are pronounced differences between the habitats of the two croton varieties. The Alabama variety occurs on shallow soils and rock outcrops at mid-slope positions, and occurs in areas with intense drought and high soil and air temperatures. The croton groves in Alabama have few or no large trees, are dominated by shrubs, and have relatively few herbs (Farmer 1962).

**Texas and Fort Hood:** The Texas variety grows on shallow, moderately alkaline, gravelly or stony clay or clay–loam overlying Cretaceous limestone (Ginzburg 1992). This variety forms dense local thickets as understory shrubs in mesic canyon hardwood forests or in full sun. The bark is thin and populations are generally confined to more mesic areas near streams and in canyons. However, populations were observed regenerating from root sprouts after fires in 1996.

Aplet et al. (1994) report that on Fort Hood, this croton variety grows in deep soils on toe slopes and fluvial deposits of canyon bottoms and is thus a drought avoider. They indicate that its occurrence exhibits no association with overstory gaps, disturbance, or particular fluvial geomorphic features. It appears to be restricted to canyon bottoms characterized by mesic conditions provided by the presence of overstory cover and a number of other species. Steeper stream gradients may produce microhabitat that is not conducive to establishment and growth.

## Reproductive Biology

**Alabama:** The reproductive biology of the Alabama variety was evaluated by Farmer (1962). He observed no evidence of asexual reproduction, although the species has been propagated by stem cuttings. In nature, plants require five to seven years of growth prior to onset of sexual reproduction. Flower buds are produced in May or June and overwinter before flowering in mid-March. Plants are self-fertile, with pistillate flowers often most numerous toward the bottom of the plant. Wind is the primary pollination agent. Fruits develop by mid-May. Seeds are dispersed up to about seven meters from the parent by a catapulting mechanism. A heavy seed crop is produced each year, much of it lost to rodents, birds, and possibly ants. Partial shade can reduce seed production by 10 to 50 percent. Forest cover can reduce it by 75 to 95 percent. Seeds, which require cold stratification, are dormant until germination takes place in February or March.

**Texas and Fort Hood:** Relatively little has been published about the reproductive biology of the Texas variety. Ginzburg (1992) reports that it flowers from February to March, sets fruit in May, and fruits have dehisced by early June. In contrast to the Alabama variety, Aplet et al. (1994) reported good evidence of asexual reproduction. This involved the production of “new upright shoots through the nodal rooting (layering) of prostrate branches.”

## Survival and Growth

**Alabama:** The survival and growth in the Alabama variety have been fairly well studied. Seed survival is probably very low, perhaps one percent of seed production (Farmer 1962). Seedling mortality may be quite high as well. In experimental populations, Farmer (1962) reported 20 percent survival to two years. Clonal stands are all-aged and consist of individuals as old as 21 years (Farmer 1962). Following germination, seedlings grow until dormancy begins in June in Alabama (Farmer 1962). Most consistent plant growth occurs during March and April. More erratic growth occurs during periods of high moisture. Leaves turn yellow by mid-June. Growth of primary roots is restricted largely to the first two centimeters, with the remainder of root growth within 15 cm even on deeper soils.

**Texas and Fort Hood:** Aplet et al. (1994) reported that all size and age classes of the Texas variety are well represented on Fort Hood, indicating a

healthy population of adults, juveniles, and new recruits. Little else has been reported about the survival and growth of the Texas variety.

### **Interactions with Other Species**

**Alabama:** Other plant species characteristically found in association with the Alabama variety include golden St. Johnswort (*Hypericum* sp.), skunkbush sumac, and red cedar (*Juniperus virginiana*), with sumac usually most abundant (Farmer 1962). Seeds are thought to be utilized by various rodents, birds, and perhaps ants (Farmer 1962).

**Texas and Fort Hood:** On Fort Hood, species associated with the Texabama croton occur in the Texas Oak Series mesic limestone canyon forest community (Diamond 1992, Ginzburg 1992). There is some indication that high cover of Texas ash and chinquapin oak (*Quercus muehlenbergii*) indicates a good site for this croton variety (Aplet et al. 1994).

The dominant plant species observed where this variety is found on Fort Hood include Ashe juniper (accounting for 53.6 percent of total cover), Texas ash (24.1 percent), Texas red oak (23.7 percent), and mustang grape (*Vitis mustangensis*, 15.9 percent). Other relatively common species include chinquapin oak (9.8 percent), Carolina buckthorn (7.4 percent), deciduous holly (*Ilex deciduas*, 7.2 percent), cedar elm (6.1 percent), Arizona walnut (4.1 percent), and Texas hackberry (*Celtis laevigata* var. *texana*, 3.04 percent) (Aplet et al. 1994). Within the two canyons in which it occurred, understory cover of the Texabama croton averaged 10.4 percent (Aplet et al. 1994).

### **Cave-adapted Fauna**

Troglobite faunal communities of Texas (cave-adapted organisms) are often represented by rare endemics due to the narrow ecological niche and natural isolation of the cave systems they inhabit. The objective of this ESMP is to provide adequate protective measures to avoid listing cave-adapted species found on Fort Hood under the Endangered Species Act. Several endemic and currently undescribed cave invertebrate species and one probable new subspecies of salamander (*Plethodon albagula*) occur on Fort Hood.

A series of cave and karst investigations at Fort Hood have found at least seventeen species of troglobite or possible troglobite endemic to Fort Hood (Reddell and Veni 2004); of these, four species are probably new:

Spiders:

*Cicurina (Cicurella) caliga* Cokendolpher and Reddell

*Cicurina (Cicurella) coryelli* Gertsch

*Cicurina (Cicurella) hoodensis* Cokendolpher and Reddell

*Cicurina (Cicurella) mixmaster* Cokendolpher and Reddell

*Cicurina (Cicurella) troglobia* Cokendolpher

*Neoleptoneta paraconcinna* Cokendolpher and Reddell

Pseudoscorpions:

*Tartarocreagris hoodensis* Muchmore

Centipedes

*Gosibius (Abatobius)* new species

Millipedes:

*Speodesmus castellanus* Elliott

Silverfish:

*Texoreddellia* probable new species

Ground beetles:

*Rhadine reyesi* Reddell and Cokendolpher

Ant-like litter beetles:

*Batrisodes (Babnormodes)* new species no. 1

*Batrisodes (Babnormodes)* new species no. 2

*Batrisodes (Babnormodes)* new species no. 3

*Batrisodes (Babnormodes) feminiclypeus* Chandler and Reddell

*Batrisodes (Babnormodes) gravesi* Chandler and Reddell

*Batrisodes (Babnormodes) wartoni* Chandlere and Reddell

## Nomenclature and Classification

### Species 1.

**Scientific Name:** *Cicurina (Cicurella) caliga*

**Family:** Dictynidae

**Original Description:** Cokendolpher and Reddell (2001)

**Type Specimen:** The female holotype is from Triple J Cave, November 1994 (collected by M. Warton) and is deposited in the American Museum of Natural History. The following paratypes were designated: two females from Triple J Cave, 13 June 2000 (collected by J. Krejca, J. Reddell, M. Reyes, P. Sprouse) and deposited in the Texas Memorial Museum; one female from Triple J Cave, 14 June 2000 (collected by J. Krejca, J. Reddell, M. Reyes, P. Sprouse), and retained in the collection of James C. Cokendolpher; one female from Buchanan Cave, 5 May 1999 (collected by J. Reddell, M. Reyes), and deposited in the Texas Memorial Museum; one female from Streak Cave, 13 June 2000 (collected by J. Krejca, J. Reddell, M. Reyes, P. Sprouse), and deposited in the Texas Memorial Museum.

**Current Federal Status:** Species of Concern

### **Species 2.**

**Scientific Name:** *Cicurina (Cicurella) coryelli*

**Family:** Dictynidae

**Original Description:** Gertsch (1992)

**Type Specimen:** The female holotype is from Tippit Cave, 31 January 1992 (J. Reddell, M. Reyes), and is in the American Museum of Natural History.

**Current Federal Status:** Species of Concern

### **Species 3.**

**Scientific Name:** *Cicurina (Cicurella) hoodensis*

**Family:** Dictynidae

**Original Description:** Cokendolpher and Reddell (2001)

**Type Specimen:** Female holotype from Buchanan Cave, 7 May 1998 (L.J. Graves, J. Reddell, M. Reyes), deposited in the American Museum of Natural History. The following paratypes have been designated: 2 females paratypes from Buchanan Cave, 7 May 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 in the Texas Memorial Museum, 1 in the James C. Cokendolpher collection; 3 female paratypes from Buchanan Cave, 4 November 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), in the Texas Memorial Museum; 4 female paratypes from upper level of Buchanan Cave, 13 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 3 in Texas Memorial Museum, 1 in James C. Cokendolpher collection; 1 female paratype from Camp 6 Cave No. 1, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), in Texas Memorial Museum; 1 female paratype from Camp 6 Cave No. 1, 2



November 1998 (J. Cokendolpher, J. Reddell), in Texas Memorial Museum; 1 female paratype from Peep in the Deep Cave, 3 November 1998 (J. Cokendolpher, J. Reddell), in Texas Memorial Museum; 1 female paratype from Peep in the Deep Cave, 5 May 1999 (J. Reddell, M. Reyes), in Texas Memorial Museum; 1 female paratype from Talking Crows Cave, 2 November 1998 (M. Reyes), in Texas Memorial Museum; 1 female paratype from Treasure Cave, 2 November 1998 (J. Cokendolpher, J. Reddell, M. Reyes), in Texas Memorial Museum.

**Current Federal Status:** Species of Concern

#### **Species 4.**

**Scientific Name:** *Cicurina (Cicurella) mixmaster*

**Family:** Dictynidae

**Original Description:** Cokendolpher and Reddell (2001)

**Type Specimen:** The female holotype is from Mixmaster Cave, 5 November 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), in American Museum of Natural History

**Current Federal Status:** Species of Concern

#### **Species 5.**

**Scientific Name:** *Cicurina (Cicurella) troglobia* new species

**Family:** Dictynidae

**Original Description:** Cokendolpher (in press)

**Type Specimen:** The female holotype is from Seven Mile Mountain Cave, 28 June 2000 (J. Reddell, M. Reyes), deposited in the American Museum of Natural History.

**Current Federal Status:** Species of Concern

#### **Species 6.**

**Scientific Name:** *Neoleptoneta paraconcinna*

**Family:** Leptonetidae

**Original Description:** Cokendolpher and Reddell (2001)

**Type Specimen:** The holotype male is from Peep in the Deep Cave, 21 April 1998 (J. Reddell, M. Reyes), in the American Museum of Natural History. The following paratypes have been designated: 1 female paratype from Peep in the Deep Cave, 21 April 1998 (J. Reddell, M. Reyes), in the Texas Memorial Museum; 1 male paratype from Camp 6 Cave No. 1, 5 May 1999 (J. Reddell, M. Reyes), in the Texas Memorial Museum; 1 female paratype from Figure 8 Cave, 20 April 1998 (L.J. Graves, J. Reddell, M.

Reyes), in the Texas Memorial Museum.

**Current Federal Status:** Species of Concern

**Species 7.**

**Scientific Name:** *Tartarocreagris hoodensis*

**Family:** Neobisiidae

**Original Description:** Munchmore (1999)

**Type Specimen:** Female holotype from Chigioux's Cave, 21 November 1995 (J. Reddell, M. Reyes), in Florida State Collection of Arthropods; allotype male from Buchanan Cave, 4 November 1998 (J.C. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), in Florida State Collection of Arthropods; paratype female from Rugger's Rift Cave, 5 November 1998 (J. Reddell, M. Reyes), in Florida State Collection of Arthropods.

**Current Federal Status:** Species of Concern

**Species 8.**

**Scientific Name:** *Speodesmus castellanus* Elliott

**Family:** Fuhrmannodesmidae

**Original Description:** Elliott (in press)

**Type Specimen:** Male holotype from Rocket River Cave, 16 January 1992 (L.J. Graves, C. Savvas), deposited in the American Museum of Natural History. Male and female paratypes with same data also deposited in the American Museum of Natural History.

**Current Federal Status:** Species of Concern

**Species 9.**

**Scientific Name:** *Texoreddellia*

**Family:** Nicoletiidae

**Original Description:** Currently undescribed. Known only from two caves on Fort Hood.

**Type Specimen:** No type specimen exists.

**Current Federal Status:** Species of Concern

**Species 10.**

**Scientific Name:** *Rhadine reyesi*

**Family:** Carabidae

**Original Description:** Reddell and Cokendolpher (2001)

**Type Specimen:** Male holotype from Tippit Cave, 8 April 1999 (M. Reyes), in the American Museum of Natural History. The following para-

types have been designated: One paratype female from Tippet Cave, 8 April 1999 (M. Reyes), in the American Museum of Natural History; one paratype male from Tippet Cave, 8 April 1999 (M. Reyes), in the Texas Memorial Museum; one paratype male from Tippet Cave, 8 April 1999 (L.J. Graves), in the Texas Memorial Museum; one paratype male from Tippet Cave, 31 January 1992 (J. Reddell, M. Reyes), in the Texas Memorial Museum; two paratype males from Tippet Cave, 9 February 1992 (J. Reddell, M. Reyes), in the Texas Memorial Museum; three paratype males and three paratype females, 3 November 1992 (J. Reddell, M. Reyes), in the Texas Memorial Museum; one paratype female, 6 November 1992 (J. Reddell, M. Reyes), in the Texas Memorial Museum; one paratype male and one paratype female, 16 July 1993 (D. McKenzie, J. Reddell, M. Reyes), in the University of Texas A&M.

**Current Federal Status:** Species of Concern

#### **Species 11.**

**Scientific Name:** *Batrisodes (Babnormodes)*

**Family:** Staphylinidae

**Original Description:** Species is undescribed. Only known to exist in one cave on Fort Hood.

**Type Specimen:** None exists.

**Current Federal Status:** Species of Concern

#### **Species 12.**

**Scientific Name:** *Batrisodes (Babnormodes) feminiclypeus*

**Family:** Staphylinidae

**Original Description:** Chandler and Reddell (2001)

**Type Specimen:** Male holotype from Skeeter Cave, 18 May 1999 (L.J. Graves, J. Reddell, M. Reyes), in the Field Museum of Natural History. The following paratypes have been designated: three males from Skeeter Cave, 18 May 1999 (L.J. Graves, J. Reddell, M. Reyes), in the Texas Memorial Museum.

**Current Federal Status:** Species of Concern

#### **Species 13.**

**Scientific Name:** *Batrisodes (Babnormodes) gravesi*

**Family:** Staphylinidae

**Original Description:** Chandler and Reddell

**Type Specimen:** Holotype male from Streak Cave, 26 September 1997

(L.J. Graves, J. Reddell, M. Reyes), in Field Museum of Natural History. The following paratypes have been designated: four females from Streak Cave, 6 October 1995 (M. Warton); one female from Buchanan Cave, 7 May 1998 (L.J. Graves, J. Reddell, M. Reyes); one male from Bumelia Well Cave, 28 October 1994 (D. Allen, D. Love); 1 male from Bumelia Well Cave, 4 November 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes); 1 male from Figure 8 Cave, 9 February 1996 (M. Warton); 1 female from Lucky Rock Cave, 10 September 1997 (L.J. Graves, J. Reddell, M. Reyes); 1 male from Price Pit Cave, 6 May 1999 (J. Reddell, M. Reyes); 1 female from Triple J Cave, 4 October 1995 (M. Warton); 3 males from Triple J Cave, 23 April 1998 (L.J. Graves, J. Reddell, M. Reyes); 1 female from Keyhole Cave, 6 May 1999 (J. Reddell, M. Reyes); 1 female from Mix-master Cave, 5 November 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes).

**Current Federal Status:** Species of Concern

#### **Species 14.**

**Scientific Name:** *Batrisodes (Babnormodes) wartoni*

**Family:** Staphylinidae

**Original Description:** Chandler and Reddell (2001)

**Type Specimen:** Holotype male from Rocket River Cave, 27 October 1994 (M. Warton), in Field Museum of Natural History. The following paratypes have been designated: 1 female from Chigioux's Cave, 21 November 1995 (J. Reddell, M. Reyes); 2 females from Tippit Cave, 9 February 1992 (J. Reddell, M. Reyes); 1 male from Tippit Cave, 31 January 1992 (J. Reddell, M. Reyes); 1 female from Tippit Cave, 3 November 1992 (J. Reddell, M. Reyes); 1 female from Tippit Cave, 6 November 1992 (J. Reddell, M. Reyes); three females from Tippit Cave, 1 July 1993 (D. McKenzie, J. Reddell, M. Reyes).

**Current Federal Status:** Species of Concern

#### **Population Estimates**

Due to their inaccessibility, rarity, and often secretive nature, population estimates are not available (Reddell and Veni 2004). Also, long periods of drought and similar conditions affect the ability to consistently detect many of these species' presence.

### **Geographic Distribution**

None of the species of concern considered for this plan are known to occur outside of Fort Hood (Reddell and Veni 2004). The primary source of information on the distribution of the species of concern at Fort Hood is a previous report (Reddell 2002).

### **Threats to Survival**

Cave invertebrates typically are found in moist caves with constant humidity and temperature (USFWS 1994). Caves occupied by endangered invertebrates in Travis and Williamson Counties, Texas, are small and as shallow as three meters. Species associated with these caves were listed primarily to mitigate threats due to increasing urbanization. The largest has only 60 m of passage (Chambers and Jahrsdoerfer 1988). The cave fauna depend on surface water infiltration. If caves become dry during certain periods of the year, the resident fauna may retreat to deeper, inaccessible parts of the system. Troglobites are entirely dependent upon surface organisms and other troglobites and troglophiles for their energy and nutrients (USFWS 1994). Fort Hood has numerous cave and karst features, and the associated invertebrates are vulnerable to military activities.

Based on proposed species as identified by USFWS (1998), Reddell and Veni (2004) identified the following factors as potential threats to cave fauna:

1. Construction: No construction has occurred outside of the cantonment area; however, this could change. Such activities in karst areas could destroy or lead to the pollution of cave environments.
2. Soil Erosion: Erosion can alter the food chain, impact drainage, or completely fill in and eliminate cave habitat. Fifteen caves containing karst invertebrates are impacted by erosion. Many additional sinks are filled in from erosion.
3. Water Quality: Toxicological studies have not been conducted on waterborne contaminants on the karst invertebrates. However, adverse impacts of a wide variety of organic chemicals, heavy metals, and other contaminants on other organisms suggest probable harmful effects on karst spe-

cies. Potential sources of contamination include vehicle fuel/oil spills, and residues from explosives and other ordnance.

4. Training Activity: Filling in of cave features by close proximity vehicle traffic represents a likely threat to karst habitat. Also, trash left from troop activity has historically been found in caves and sinks.

5. Predation: Red imported fire ants are abundant on Fort Hood and could pose a threat. Taylor and Phillips (2003) studied six caves on Fort Hood. They reported no findings of mass infestations of caves; however, they did find evidence of foraging trails inside caves.

Refer to Reddell and Veni (2004) for a detailed listing of the above threats.

### **Salamander (*Plethodon albagula*)**

In addition to the previous 17 species, specimens of the probable new salamander subspecies (*Plethodon albagula*) have been collected from caves in the northeast training ranges of Fort Hood. These new specimens are undergoing taxonomic review to determine species status. This subspecies is presumably not cave-restricted and has a limited geographical range. Taylor and Phillips (2003) provide data and this species' distribution and morphological measurements on Fort Hood. Taylor and Phillips (2003) failed to show a relationship between the presence/absence of *Plethodon* based on fire ants. However, their results were not conclusive.

### **Other Species**

Additional listed species occur either as accidental or as transients on Fort Hood (Table 1). For some of these species, detailed management plans are not warranted at this time due to infrequent, transient occurrence on the installation. Only species discussed briefly below are considered further in this ESMP.

#### **Bald Eagle**

The bald eagle has been recorded during winters at Belton Lake on or adjacent to Fort Hood (J. Cornelius, personal communication). The bald eagle does not nest on the installation.

**Whooping Crane**

The whooping crane also is a rare migrant. Five whooping cranes were sighted in Land Group 3 during December 1986. They may fly over or near Fort Hood during spring (1–20 April) and fall (1–20 October) migration (Diersing et al. 1985). They may stop at Belton Lake during migration.

**Peregrine Falcon**

Anecdotal observations of peregrine falcons have been recorded on Fort Hood. Peregrine falcons do not nest on the installation and observations are likely transitory migrants.

## **4 Conservation Actions: All Federally Listed Species**

### **Objective 1**

*Regardless of habitat designation on training area maps, the Army will comply with all applicable sections of the Endangered Species Act (1973, as amended) for all training, operations, maintenance, and construction activities conducted on Fort Hood.*

#### **Objective Justification**

This ESMP does not supersede the legal obligation of the Army and Fort Hood to comply with Federal law as set forth in the Endangered Species Act (1973, as amended).

#### **Conservation Actions**

As required by Section 7 of the Endangered Species Act, the Army and Fort Hood will assess the effect of any proposed activity on any listed species or its habitat occurring in the project area. Fort Hood has conducted a biological assessment for the current ongoing mission and the USFWS has issued a Biological Opinion (16 March 2005) that provides Terms and Conditions for the continuance of mission activities on Fort Hood. Fort Hood currently is in compliance with the Terms and Conditions of the 2005 Biological Opinion. Some areas on Fort Hood are subject to training restrictions under the Fort Hood Endangered Species Training Guidelines due to the presence of listed species and are designated on Fort Hood Training Area maps. Areas not subject to training restrictions under the Fort Hood Training Guidelines are still subject to all Section 7 compliance requirements and Terms and Conditions of the USFWS 2005 Biological Opinion.

### **Objective 2**

*Implement installation fire management and protection policies.*



**Objective Justification**

The objective of Fort Hood fire management policies is to provide a balance among operational flexibility, endangered species habitat management requirements, and prevention of destructive wildfires. One objective of the Fort Hood fire management policy is to reduce downtime for training operations due to excessive fire control activities. Many training-related fires are of low risk to facilities, personnel, or habitats of concern. In these cases a “let-burn” policy is warranted. Also, black-capped vireo habitat requires some level of periodic disturbance to maintain optimal habitat conditions. Periodic fires in these habitats help to maintain these conditions. On the other hand, uncontrolled wildfires can pose a serious risk to range facilities, personnel, and large areas of endangered species habitats, as demonstrated by the extensive wildfires that occurred in February 1996.

**Conservation Actions**

Implement fire-rating system and control procedures in accordance with Fort Hood OPLAN 8-93 “Operation Brush Fire” and Fort Hood Regulation 350-40.

Monitor effects of all fires on endangered species habitat occurring on the installation. Fort Hood will maintain records on the date and areas of endangered species habitat affected, and report these data annually to the USFWS.

Coordinate between the Fire Department and Natural Resources Management Branch during the decision to approve/disapprove Range Condition Red waivers.

Emphasize use of preventative prescribed fire to maintain blacklines near habitat areas annually. Employ firebreaks in association with endangered species habitats to reduce fire risk.

Maintain and upgrade fire-fighting capabilities including aerial support, subject to the availability of funds.

Continue research on the effects of the February 1996 wildfires.

### Objective 3

*Manage vegetation clearing projects to minimize fire hazard from slash, and avoid impacts to residual stands.*

#### Objective Justification

Vegetation clearing activities are conducted on Fort Hood for military range maintenance and habitat management, and to reduce fire hazard. Vegetation removal potentially can increase erosion rates. The resulting slash from these activities poses a significant fire risk if not disposed of properly. If left in place, slash piles can impact survival of residual live vegetation. Proper disposal of slash is required to avoid these risks.

#### Conservation Actions

Reduce fire hazard from juniper clearing, brush removal projects, construction of firebreaks, etc., by avoiding piling slash material around or against live trees and removing slash from the site or burning or mulching in place. Slash disposal methods will be included in the scope of proposed projects.

Where possible, mulch slash material on site rather than removing or burning, in order to return nutrients to the soil and reduce erosion.

As an integral part of project design, maximize the use of preventative measures to minimize soil loss after vegetation removal. Examples include re-seeding with native herbaceous plant seed, deferral of grazing from rehabilitation sites, placement of water bars on slopes, and using waste material in gullies as appropriate.

Coordinate all vegetation clearing with Natural Resources Management Branch from the planning phase forward in order to minimize or avoid impacts to endangered species and their habitat, and support overall objectives of the INRMP, of which the ESMP is a part.

### Objective 4

*Emphasize the use of prescribed burning to support protection and maintenance of endangered species habitat, and support ecosystem management principles.*

**Objective Justification**

Periodic disturbance is an important functional component of most natural systems. Natural disturbance typically supports enhanced biodiversity, nutrient cycling, and habitats for many endangered species and species of concern. In central Texas, fire is the primary natural disturbance regime in upland habitats. During recent historical periods, fire suppression has resulted in juniper encroachment, loss of deciduous scrub habitats, and increases in invasive, non-native grasses and forbs. Prescribed burning provides land managers a tool to more nearly replicate pre-settlement landscape and habitat conditions on Fort Hood in support of endangered species management and ecosystem function.

**Conservation Actions**

All prescribed burning must be overseen by Natural Resources Management Branch personnel certified and experienced in prescribed burning techniques, and must support the overall objectives of the INRMP.

Develop a habitat regeneration/enhancement plan that is compatible with endangered species management and mission training requirements.

Identify areas suitable for maintenance as black-capped vireo habitat and implement habitat management prescriptions as necessary.

Use prescribed fire to the maximum extent possible to reduce fuel loads near important areas.

Use prescribed fire to maintain prairie sites and to inhibit development of pure juniper stands. Fire should be considered as a low-cost, non-invasive means of avoiding future need for destructive large-scale mechanical clearing projects.

**Objective 5**

*Evaluate factors affecting endangered species productivity, survival, and habitats.*

**Objective Justification**

Several non-specific threats to endangered species populations occur on Fort Hood. These threats include direct and indirect effects due to imported fire ants and feral hog populations. Control of these non-native species will benefit a broad range of natural resource components on the installation, including endangered species populations.

**Conservation Actions**

Investigate species-selective methods, including hot-water injection methods, for control of imported fire ants in endangered species habitat and near important karst features.

Continue to control feral hog population utilizing aerial support and trapping, and evaluate effectiveness of control methods.

**Objective 6**

*Monitor the quality and quantity of available endangered species habitat.*

**Objective Justification**

Incidental take and reduction in training restrictions under the Fort Hood Biological Opinion (16 March 2005) is contingent on availability and maintenance of suitable habitat to support viable endangered species populations on the installation. Meeting this objective requires adequate information on the current and future status of habitats on the installation and adequate oversight to ensure compliance with installation regulations on allowable activities within endangered species habitats.

**Conservation Actions**

Continue use of helicopter over-flights as needed to ensure compliance with training guidelines, monitor effects of training activity in endangered species habitat, and monitor oak wilt centers.

Evaluate habitat trends based on change detection imagery every five years.

Maintain adequate natural resource law enforcement presence to effectively monitor land use, and enforce training guidelines and off-road vehicle restrictions.

Refine mapping efforts to enhance endangered species information management on Fort Hood.

## **Objective 7**

*Maintain and distribute training area maps with overlay of areas subject to Fort Hood Endangered Species Training Guidelines (Fig. 2).*

### **Objective Justification**

Soldiers performing field training must have access to current maps showing designated restricted areas in order to comply with requirements of the Fort Hood Endangered Species Training Guidelines as specified in the USFWS Biological Opinion (Appendix A). Conservation actions to meet this objective will ensure to the extent possible that all soldiers and commanders on Fort Hood have access to current information on the location of restricted areas.

### **Conservation Actions**

Training area maps will be revised to show areas in the maneuver training ranges subject to conditions of the Fort Hood Endangered Species Training Guidelines in accordance with habitat designations established under this ESMP. Areas subject to the Endangered Species Training Guidelines on maneuver training areas will be labeled as “Training Restricted Zones” on training area maps.

Revised training area maps will be issued or available to all applicable installation commands and training support elements. All earlier editions will be collected and destroyed to the extent possible.

Training area maps will be revised every five years concurrent with the five-year revision of this ESMP to incorporate any changes in designated habitats subject to training restrictions.

## 5 Conservation Actions: Golden-Cheeked Warbler

### Objective 1

*Maintain sufficient habitat to support a minimum carrying capacity of 2,000 singing males.*

#### Objective Justification

Population viability analyses indicate that habitat carrying capacity lower than that necessary to support a maximum of 1,000 singing males of golden-cheeked warblers greatly increases the probability of extinction (Hayden et al. 2001). Increasing carrying capacities above 1,000 singing males does not significantly alter the probability of extinction. Carrying capacity represents the *maximum* potential of the habitat to support singing males. Carrying capacity does not necessarily reflect the number of singing males normally expected to occur. However, increases in carrying capacity above 1,000 singing males does increase the expected number of singing males present. Maintaining carrying capacity in excess of 1,000 singing males also provides some buffer in the event of catastrophic loss of habitat or birds. A carrying capacity of 2,000 exceeds the threshold for increased extinction risk and provides capacity for the presence of substantial numbers of singing males in excess of current USFWS recovery goals.

#### Conservation Actions

Population viability analysis (PVA) for Fort Hood indicates a minimum of 8,520 ha (21,053 ac) of habitat is necessary to provide a carrying capacity for 2,000 singing males. Current estimate of available habitat on Fort Hood is 21,422 ha (52,935 ac). Under current assumptions and parameter estimates of the PVA, enough habitat currently exists on Fort Hood to meet this objective. The Conservation Action to meet this objective will be to minimize any loss of warbler habitat on Fort Hood due to fire, training, or other habitat-altering activities in accordance with protection and management objectives established under this ESMP.

## Objective 2

*Implement training restrictions in designated “core” habitats in accordance with Fort Hood Endangered Species Training Guidelines.*

### Objective Justification

Military training in areas occupied by golden-cheeked warblers can destroy habitat and disturb individuals, potentially resulting in reduced abundance and productivity. These impacts increase the possibility of “take” as defined in the ESA. The Fort Hood Biological Opinion (16 March 2005) states that implementation of the Fort Hood Training Guidelines in golden-cheeked warbler habitat will assist in minimizing effects of incidental take related to military training activities. “Core” habitat areas designated under this objective were selected based on known population distributions, quality and contiguity of habitat, and minimal mission conflicts.

### Conservation Actions

Implement Fort Hood Endangered Species Training Guidelines as specified in the USFWS Biological Opinion (Appendix A) for 3,861 ha (9,541 ac) of golden-cheeked warbler habitat designated as “core” habitats (Fig. 2).

Provide orientation and training for appropriate personnel on the implementation of the guidelines.

The Fort Hood Natural Resources Management Branch will maintain records and maps of all areas occupied by endangered species, including both non-core and core habitats designated under the Fort Hood Endangered Species Training Guidelines.

“Non-core” habitat areas will remain subject to all other applicable Fort Hood range regulations, in particular regulations governing activities that could result in permanent alteration to endangered species habitat. An example would be the requirement to submit for approval Excavation Permit #420-X10 prior to initiating any excavation activities on the installation.

### Objective 3

*Implement a sustainable incidental take limit for the five-year term of this ESMP.*

#### Objective Justification

The intent of this ESMP is to promote recovery of endangered species on Fort Hood lands while permitting the military maximum flexibility to perform mission-essential tasks. Current estimates of available golden-cheeked warbler habitat on Fort Hood exceed population and recovery goals under this ESMP. Implementation of incidental take limits provides flexibility for conducting mission activities that may result in habitat loss. However, this potential habitat loss is limited so as not to jeopardize base-line habitat requirements and to provide an adequate habitat mitigation bank in perpetuity without implementing further restrictive measures on the military mission. Habitat “loss” as defined under this ESMP is any permanent or temporary alteration of currently suitable habitat to the extent that it is unsuitable for occupation by breeding adults.

#### Conservation Actions

Maintain habitat loss due to training activities over the next five-year period below the 660 ha (1,631 ac) and 125 nests limits established under the Fort Hood Biological Opinion (16 March 2005).

Maintain habitat loss due to construction and range improvements over the next five-year period below the 217 ha (536 ac) limit established under the Fort Hood Biological Opinion (16 March 2005).

Any loss of habitat or nests considered incidental take will be reported on an annual basis to the installation Commander and to the USFWS as part of the installation’s annual reporting requirement.

### Objective 4

*Maintain currently available habitat consistent with population carrying capacity goal and essential mission requirements.*



**Objective Justification**

Fort Hood currently provides sufficient habitat to meet population carrying capacity goals under this ESMP and to exceed USFWS recovery objectives. Limited opportunities exist to further increase habitat availability. Maintenance of these habitats in excess of USFWS recovery goals will promote the long-term survival of the species, which is in the interest of the Army and Fort Hood to achieve greater training flexibility.

**Conservation Actions**

Develop and maintain a current map of oak wilt centers, with particular emphasis on training areas where core endangered species habitat occurs.

Identify and prioritize oak wilt centers that threaten, or may potentially threaten, core habitat.

Investigate treatment and/or isolation methods that might be feasible to limit oak wilt effects.

Implement appropriate oak wilt control measures based on priority evaluation.

If fungal mats are identified on trees that necessitate removal of that tree during the breeding season, a representative of the Natural Resources Management Branch will be present to ensure that the tree is not being directly utilized by the golden-cheeked warbler as a nesting site. Every effort will be taken to avoid or minimize a direct impact to listed species as a result of management for oak wilt.

Investigate the effects of oak wilt on golden-cheeked warbler habitat.

Prohibit the use of motorized off-road recreational vehicles in endangered species habitat.

**Objective 5**

*Document golden-cheeked warbler population trend and factors affecting population status.*

**Objective Justification**

Population change is the baseline measure of conservation success and recovery for the population. This measure is necessary to differentiate between normal annual variability and true trends in populations over time. Evaluation of factors affecting populations allows determination of population change due to natural or stochastic processes versus change due to human land use practices.

**Conservation Actions**

Document population trends and assess population status of the golden-cheeked warbler.

Evaluate the effects of de-designation of Core Habitat on golden-cheeked warbler demography and productivity.

Evaluate the relationship between habitat quality and golden-cheeked warbler abundance and productivity.

Evaluate fire-related dispersal patterns of golden-cheeked warblers.

Continue to allow safe access to training and Live-Fire Areas for golden-cheeked warbler surveys during the period 15 March through 31 July to ensure that equivalent data are collected for study areas both in and out of the Live-Fire Area. It is important that the integrity of data collected from existing golden-cheeked warbler productivity, predation, and population trend studies is maintained.

Continue to generate color sequences for range-wide color banding of golden-cheeked warblers through cooperation with the U.S. Geological Survey.

Investigate the dispersal of golden-cheeked warblers from Fort Hood to surrounding areas through cooperative studies with other researchers and at Corps of Engineers property at Belton Lake and Stillhouse Hollow Lake.

Conduct point count censuses on a minimum of 318 points to obtain numbers of birds detected per location per observer, annually.

Determine numbers of singing males within designated intensive study areas, annually.

Conduct the following activities annually in each of the intensive study areas:

- Band all adults possible with a unique combination of leg bands.
- Locate and monitor active nests to the extent possible.
- Search for returning, banded birds.
- Band juveniles (HY).

Monitor the following demographic and reproductive parameters annually in all intensive study areas:

- Banding status of all birds observed.
- Presence or absence of a female on each male territory.
- Territory size.
- Number of young with each adult.
- For all nests located: number of host and parasite eggs, nestlings, fledglings, and nest fate.
- Distance from banding location to resighting location in subsequent years.
- As time permits, search areas throughout the installation where birds have been banded in the past for returning birds, including returning HY.

## 6 Conservation Actions: Black-Capped Vireo

### Objective 1

*Maintain sufficient habitat to support a minimum carrying capacity of 1,000 singing males.*

#### Objective Justification

Population viability analyses indicate that habitat carrying capacity lower than that necessary to support a maximum of 1,000 singing males of black-capped vireos greatly increases the probability of extinction (Hayden et al. 2001). Increasing carrying capacities above 1,000 singing males does not significantly alter the probability of extinction. Carrying capacity represents the *maximum* potential of the habitat to support singing males. Carrying capacity does not necessarily reflect the number of singing males normally expected to occur. A population carrying capacity goal in excess of 1,000 singing males would not significantly lower extinction probability or significantly increase expected number of individuals. A population carrying capacity goal of 1,000 singing males meets USFWS recovery objectives for this species.

#### Conservation Actions

Population viability analysis (PVA) for Fort Hood indicates a minimum of 4,170 ha (10,304 ac) of black-capped vireo habitat is necessary to provide a carrying capacity for 1,000 singing males (Hayden et al. 2001). Current estimate of available habitat on Fort Hood is 6,967 ha (17,216 ac) (Cimprich 2003). Under current assumptions and parameter estimates of the PVA, enough habitat currently exists on Fort Hood to meet this objective. The conservation action to meet this objective will be to minimize any loss of black-capped vireo habitat on Fort Hood due to fire, training, or other habitat-altering activities in accordance with protection and management objectives established under this ESMP.

### Objective 2

*Implement a sustainable incidental take limit for the five-year term of this ESMP.*

**Objective Justification**

The intent of this ESMP is to promote recovery of endangered species on Fort Hood lands while permitting the military maximum flexibility to perform mission-essential tasks. Current estimates of available black-capped vireo habitat on Fort Hood exceed population and recovery goals under this ESMP. Implementation of incidental take limits provides flexibility for conducting mission activities that may result in habitat loss. However, this potential habitat loss is limited so as not to jeopardize baseline habitat requirements and to provide an adequate habitat mitigation bank in perpetuity without implementing further restrictive measures on the military mission. Habitat “loss” as defined under this ESMP is any permanent or temporary alteration of currently suitable habitat to the extent that it is unsuitable for occupation by breeding adults.

**Conservation Actions**

Maintain habitat loss due to training activities over the next five-year period below the 360-ha (890 ac) and 150 nests limits established under the Fort Hood Biological Opinion (16 March 2005).

Maintain habitat loss due to construction and range improvements over the next five-year period below the 108-ha (267 ac) limit established under the Fort Hood Biological Opinion (16 March 2005).

Any loss of habitat or nests considered incidental take will be reported on an annual basis to the installation Commander and to the USFWS as part of the installation’s annual reporting requirement.

**Objective 3**

*Maintain sufficient habitat to meet population goal in seral stage suitable for occupation by black-capped vireos.*

**Objective Justification**

Typically, vireos on Fort Hood are observed in early successional habitat resulting from burns or mechanical clearing of vegetation in areas with suitable soils and geologic substrate. Currently, 6,967 ha (17,216 ac) have been identified as suitable vireo habitat (Cimprich 2003). Due to the ephemeral nature of habitat in these areas targeted for habitat manage-

ment, restoration must be implemented to replace areas where vegetation has succeeded beyond the stage preferred by vireos. This objective maintains at least the current level of vireo habitat on Fort Hood.

### **Conservation Actions**

Identify areas suitable for maintenance as black-capped vireo habitat and implement habitat management prescriptions as necessary.

Develop a habitat regeneration/enhancement plan that is compatible with endangered species management and mission training requirements.

## **Objective 4**

*Maintain parasitism of vireo nests by brown-headed cowbirds below an average of 10 percent annually in training areas outside of the Live-Fire Areas during the five-year term of this ESMP.*

### **Objective Justification**

Cowbird parasitism reduces reproductive success of black-capped vireos on Fort Hood (Tazik et al. 1992, Hayden et al. 2000). Analyses by Tazik (1991) of the effect of cowbird parasitism on vireo productivity indicate that incidence of cowbird parasitism must be below 25 percent to maintain stable or increasing vireo populations. A target goal of average annual parasitism below 10 percent was determined because of effectiveness of historical control efforts and to be consistent with thresholds established by the USFWS under other agreements. Since 1992, cowbird control efforts have maintained parasitism levels below 10 percent outside of Live-Fire Areas on Fort Hood. Also, USFWS has established a 10-percent parasitism threshold in provisions of a Memorandum of Understanding with Central Texas Cattleman's Association regarding grazing leases on Fort Hood. Maintaining parasitism levels below an average of 10 percent annually will enhance vireo reproductive success on Fort Hood and support achievement of population objectives. Reducing cowbird parasitism is the only management technique currently available to directly affect reproductive success.

### Conservation Actions

Remove a sufficient number of female cowbirds during the peak vireo breeding months, March–June, to maintain parasitism levels below an annual average of 10 percent for all training areas outside of the Live-Fire Areas for the five-year term of this ESMP. Trap effort will be conducted at levels sufficient to maintain parasitism levels below the 10-percent annual target.

Shooting will be conducted within selected occupied vireo habitats where high levels of cowbird parasitism have been documented despite trapping effort.

Cowbird trapping during the months July–February will be conducted to reduce resident adult cowbird populations, reduce juvenile female abundance, reduce vandalism damage, and provide year-round presence and awareness among troops training in the field.

Implement a controlled field study, approved by the USFWS, to evaluate modifications of the current cowbird control program on the installation. The purpose of this study will be to evaluate parasitism rates in response to reduced trapping efforts in selected regions of Fort Hood, compared with areas where control efforts are maintained. Current levels of cowbird control will be maintained in LG1, LG2, and LG3, but will be discontinued in LG 4, LG5, LG6, and LG7 (Fig. 1), for at least three breeding seasons. Annual assessments of the study will be conducted using demographic modeling and sensitivity analysis, to ensure parasitism rates on the black-capped vireo population do not rise above unsustainable levels in the areas with no cowbird control. The USFWS has granted an exemption of the 10-percent parasitism threshold level, but since this threshold is for a five-year rolling average, it is not anticipated that this threshold will be exceeded significantly during the course of the three-year study.

### Objective 5

*Document black-capped vireo population trend and factors affecting population status.*

**Objective Justification**

Population change is the baseline measure of conservation success and recovery for the population. This measure is necessary to differentiate between normal annual variability and true trends in populations over time. Evaluation of factors affecting populations allows the determination of population change due to natural or stochastic processes versus change due to human land use practices.

**Conservation Actions**

Document population trends and assess population status of the black-capped vireo.

Evaluate the effects on black-capped vireo demography and productivity of the reduction of habitat area designated as Core Habitat.

Continue to allow safe access to training and Live-Fire Areas for black-capped vireo surveys during the period 15 March through 31 July to ensure that equivalent data are collected for study areas both in and out of the Live-Fire Area. It is important that the integrity of data collected from existing black-capped vireo productivity, predation, and population trend studies is maintained.

Continue to generate color sequences for range-wide color banding of black-capped vireos through cooperation with the U.S. Geological Survey.

Investigate the dispersal of black-capped vireos from Fort Hood to surrounding areas through cooperative studies with other researchers and at Corps of Engineers property at Belton Lake and Stillhouse Hollow Lake.

Determine numbers of singing males within each intensive study area, annually.

As time permits, visit all known and suspected sites of vireo occupation to document distribution of black-capped vireos on Fort Hood.

Conduct the following actions annually in each intensive study area:



- Monitor all territories in each intensive study area throughout the vireo breeding season.
- Monitor at least 40 territories in the Live-Fire Area with representation from each of five “Endangered Species Study Areas (ESSA).” Endangered Species Study Areas within the live-fire zone are designated by agreement between the installation Natural Resources Management Branch and G3. Normally, this monitoring requirement will require access to each ESSA approximately once every two weeks during the breeding season. This requirement will minimize conflict with ongoing training by maximum use of weekend training holidays, range maintenance periods, and other training downtime through coordination with G3.
- Locate and monitor all located nests on monitored territories.
- Band all adults, juveniles, and nestlings to the extent possible.

Monitor the following demographic and reproductive parameters for all monitored territories:

- Banding status of all birds observed.
- Presence or absence of a female on each male territory.
- Territory size.
- Number of young with each adult.
- For all nests located: number of host and parasite eggs, nestlings, fledglings, and nest fate.
- Distance from banding location to resighting location in subsequent years.
- Monitor successional development of habitat and vireo colonization in areas burned during the February 1996 fire.

## **7 Conservation Actions: Texabama Croton**

### **Objective 1**

*Protect known locations from human-related disturbance.*

#### **Objective Justification**

Protection of known locations of Texabama croton populations from human-related disturbance is a proactive approach to mitigate impacts and possibly prevent listing of species as threatened or endangered. Known populations are in locations where virtually no military training is conducted.

#### **Conservation Actions**

No additional action is required at this time. No land use activities that may disturb Texabama croton populations are known to occur in these areas. Natural Resources Management Branch personnel will review protection status for these areas if potential threats occur from future land use activities.

### **Objective 2**

*Monitor status and distribution of populations.*

#### **Objective Justification**

Monitoring Texabama croton population trends will provide managers with information necessary to decide whether additional protection or management actions are required to maintain viable croton populations.

#### **Conservation Actions**

Visit known locations annually to visually assess condition of known populations.

## 8 Conservation Actions: Cave-adapted Fauna

### Objective 1

*Protect sensitive cave and karst features from human-related risk factors identified in the 2004 “Management Plan for the Conservation of Rare Karst Species on Fort Hood, Bell and Coryell Counties, Texas.”*

#### Objective Justification

Human activities and changes to surrounding habitats are the greatest threat to cave-adapted fauna. Protection of cave features from these impacts is a proactive approach to mitigate potential impacts and possibly prevent listing of species potentially eligible for threatened or endangered status.

#### Conservation Actions

Gates have been placed at entrances to caves that have been identified as particularly sensitive and susceptible to human disturbance. The following actions should be followed to construct and maintain gates for sensitive cave and karst features:

- Inspect all current cave gates annually and perform any necessary maintenance.
- Identify any additional cave or karst features susceptible to human disturbance and determine whether gates would alleviate potential problems. Fund and implement construction of additional gates if appropriate.

In the vicinity of cave and karst features where military training increases risk of vegetation destruction and sedimentation, buffer zones should be implemented by placing signs or other barriers at sufficient distance from cave entrances to minimize disturbance.

## Objective 2

*Locate, map, and conduct biological collections in sensitive cave and karst features on Fort Hood.*

### Objective Justification

This objective will meet requirement of the ESA to determine presence of listed species and will identify potential for conflicts with mission and land use activities on Fort Hood.

### Conservation Actions

Conduct biological collections in known cave and karst features if such collections have not previously been performed or are incomplete.

Locate and survey cave and karst features in areas subject to military training or other land use activities that would potentially result in disturbance of these features.

## Objective 3

*Develop management plan for the possible new salamander subspecies, Plethodon albagula.*

### Objective Justification

Development of a comprehensive management plan for this new salamander subspecies will reduce the potential listing of this species due to threats to its environment or populations.

### Conservation Actions

Develop management plan based on known distributions, risk factors, and implications for mission activities.

## Objective 4

*Complete taxonomic evaluation and description of undescribed material collected from Fort Hood caves.*

**Objective Justification**

This work is necessary to identify a new species potentially eligible for listing or species that are currently listed as endangered.

**Conservation Actions**

Submit taxonomic findings to USFWS for status review.

## 9 Conservation Actions: Other Species

### Objective 1

Whooping Crane: *If whooping cranes are observed, protect from potential disturbance by military training and other land use activities.*

#### Objective Justification

The ESA requires protection from harassment for all listed species. Whooping crane presence on the installation is likely to be highly transitory during migration. For this reason, no specific protection plan appears warranted at this time. However, activity of transient individuals should be monitored to prevent potential disturbance from human activity.

#### Conservation Actions

Monitor activity of whooping cranes while present on the installation.

Notify G3, Range Control, and other appropriate training and operations organizational elements of any potential training disturbance in proximity to observed individuals.

Suspend training activities in proximity to whooping cranes until they have departed installation lands.

### Objective 2

Bald Eagle: *Minimize disturbance from low-level helicopter flights and other aviation assets.*

#### Objective Justification

The ESA requires protection from harassment for all listed species. Low-level aircraft flights can disturb wintering populations of this species occurring near Belton Lake.

**Conservation Actions**

When bald eagles are first observed in autumn, notify the Fort Hood air-space coordinator, and implement the no-fly zone. This zone is situated on and near Belton Lake in parts of Land Groups 2 and 3. Flight restrictions will be lifted when no bald eagles have been observed for a period of two weeks.

**Objective 3**

Peregrine Falcon: *If peregrine falcons are observed, monitor presence for potential disturbance from human activity.*

**Objective Justification**

The peregrine falcon was delisted by the USFWS in 1999. The ESA requires monitoring five years after delisting. Peregrine falcon presence on the installation is likely to be highly transitory during migration and not associated with any particular physical feature of the installation, as in the case for whooping cranes and bald eagles (i.e., Belton Lake). For these reasons no specific protection plan appears warranted at this time. However, activity of transient individuals should be monitored to prevent potential disturbance from human activity.

**Conservation Actions**

Monitor activity of peregrine falcons while present on the installation.

**Objective 4**

*Conduct surveys to determine presence and status of other listed, rare, and sensitive species.*

**Objective Justification**

The ESA requires Federal agencies to document the presence of and assess effects of land-use activities on any species occurring on Fort Hood lands that may be eligible or proposed for listing in the future. Documentation of these species' presence and status will meet ESA requirements and is a proactive approach to avoiding project conflicts in the future. The pre-

ferred outcome is to identify and implement necessary management actions to avoid listing of species under the ESA.

**Conservation Actions**

Installation biologists will review species listed in Table 1 annually and will revise and amend as appropriate.

Based on the installation review above, surveys will be initiated as necessary to document presence and status of listed, rare, or sensitive species on the installation.

Results of these surveys will be kept on record by the Fort Hood Natural Resources Management Branch and submitted to the USFWS.



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## **Appendix A**

**Fort Hood Biological Opinion, 16 March 2005**



## United States Department of the Interior

### FISH AND WILDLIFE SERVICE

Ecological Services  
WinSystems Center Building  
711 Stadium Drive, Suite 252  
Arlington, Texas 76011

2-12-04-F-478

March 16, 2005

Mr. Roderick A. Chisholm  
Director of Public Works  
Department of the Army  
Headquarters, U.S. Army Garrison  
Building 1001, Room W321  
Fort Hood, Texas 76544-5000

Dear Mr. Chisholm:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Department of Army's (Army) ongoing activities and proposed revision of the Endangered Species Management Plan (ESMP) at Fort Hood Military Installation in Bell and Coryell Counties, Texas, and its effects on the federally listed black-capped vireo (*Vireo atricapilla*) (BCVI) and golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA). The Army's letter requesting consultation, dated September 1, 2004, was received at our office on September 7, 2004. Following our request for additional information, the consultation was initiated on October 25, 2004.

As you are aware, formal section 7 consultation between the Service and the Army concerning Fort Hood originally began in 1992. At that time, the Service's Austin Field Office had responsibility for addressing endangered species issues at Fort Hood. The original biological opinion, dated September 23, 1993, was amended three times to accommodate the changing needs of the Army and incorporate new information regarding the conservation needs of the listed species occurring at Fort Hood. Due in part to recent resource limitations the Service has encountered and continues to experience, the responsibility for endangered species issues at Fort Hood was transferred to the Arlington Field Office in 2003.

In subsequent meetings with our office and Fort Hood staff, it became apparent that the Army wished to reassess the Fort's ESMP to better suit their mission, and therefore, we recommended the Army reinstate formal consultation. The initiative was to increase flexibility in training at Fort Hood, and as such, it was mutually agreed that a new biological opinion would be optimal, rather than another amendment to the previous opinion. While the previous opinion and its amendments would always remain a part of the consultation history and the administrative record, the new biological opinion would incorporate all ongoing activities that currently occur at Fort Hood, any proposed changes to the ESMP, an updated environmental baseline, the most

current status of the species, and a complete incidental take statement (in the event of a non-jeopardy opinion). The result would be a 'stand alone' document that could be easily referred to without reference to several other documents and/or amendments. To this end, my staff in close coordination with the Fort Hood staff, incorporated all elements necessary to complete this comprehensive biological opinion.

This biological opinion supersedes the previous opinion and its amendments. It has been prepared in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). This biological opinion is based on the Biological Assessment (BA) included with your letter initiating consultation, information provided by Fort Hood Environmental staff, and other sources of information. A complete administrative record of this consultation is on file at the Service's Arlington, Texas, Field Office (ARLFO).

### Consultation History

- 1992 to 2000: The Army, Headquarters III Corps and Fort Hood, originally initiated consultation on September 24, 1992, with the Service's Austin, Texas, Field Office, which resulted in a non-jeopardy biological opinion issued on September 23, 1993 (Service Consultation #: 2-15-93-F-003). The opinion was subsequently amended twice in 1999, and a third time in 2000 to incorporate the draft 2000-2004 ESMP, impacts from the 1996 fires, additional brown-headed cowbird minimization measures, off-road vehicle recreation, and juniper management.
- June 2003: Responsibility for endangered species issues concerning Fort Hood is transferred from the Service's Austin Office to the ARLFO.
- January 15, 2004: Initial meeting at Fort Hood to discuss changes to the ESMP with representatives from the ARLFO, Texas Parks and Wildlife Department, Texas Department of Agriculture, The Nature Conservancy, and the Leon River Restoration Project. The Army's training requirements and need for flexibility with regard to listed species encroachment, as well as plans for an off-site conservation plan were discussed. A working group was formed with representatives from each group (hereafter, ESMP Working Group) to work on the conservation plan and the revision of the Fort's ESMP.
- January 27, 2004: Meeting at Fort Hood with ESMP Working Group. Current off-site efforts through the Nature Conservancy and potential changes to the ESMP with regard to fires within the Live Fire Area were discussed. Omar Bocanegra explained the off-site plan's relationship to section 7(a)(1) and 7(a)(2) of the Act, and encouraged the Army to draft a BA with respect to changes to the current activities and/or restrictions. The BA would then be used to re-initiate consultation to address the Army's training needs and minimize impacts to listed species.

- March 25, 2004: Meeting at Fort Hood with ESMP Working Group. Proposals for off-site conservation were submitted by The Nature Conservancy, Environmental Defense, and the Leon River Restoration Project and discussed among the group. The Army discussed a draft outline of proposed changes to the ESMP.
- July 7, 2004: Meeting at Fort Hood with the Directorate of Public Works, Service, and Leon River Restoration Project representative. The ARLFO explained the consultation process to Colonel Randall Butler and staff. The Army expressed interest in expediting the consultation and indicated the draft BA was near completion.
- July 20, 2004: The ARLFO received the draft BA via electronic mail from the Army. Comments on the draft were sent to Fort Hood on August 3, 2004.
- September 7, 2004: The ARLFO received a final BA with letter requesting formal consultation with the Army on activities at Fort Hood. The ARLFO acknowledged receipt of the initiation request and asked for clarification on issues related to prescribed fire, recreational activities, and the grazing lease at Fort Hood in a letter dated October 4, 2004.
- October 25, 2004: The ARLFO received a letter from Colonel Bruzese providing supplemental information on the BA as requested. The ARLFO accepted the consultation beginning October 25, 2004, in a letter to Colonel Bruzese, dated October 28, 2004.

## **BIOLOGICAL OPINION**

### **I. Description of Proposed Action**

Fort Hood Military Reservation (hereafter, Fort Hood) provides resources and training facilities for active and reserve units in support of the Army's mission. Training activities conducted at Fort Hood include maneuver exercises for units up to brigade level, live weapons firing, and aviation training. In accordance with Army Regulation 200-3, Fort Hood has prepared and implemented an ESMP to promote the conservation of threatened and endangered species occurring on the installation while minimizing impacts on the training mission. The current ESMP was approved on October 10, 2000.

The proposed action consists of the ongoing military associated and other activities at Fort Hood and revision of the current installation ESMP. The Army and the Department of Defense (DoD) are currently undergoing major reviews of force structure and deployments under several transformation initiatives and the current round of Base Realignment and Closure activities. The ultimate outcome of these initiatives and consequences for Fort Hood, if any, are not known at this time. Also, if significant changes to the Fort Hood force structure or mission occur, these changes may not be implemented for several years. For these reasons, this project description

reflects the current force and mission structure. The action area of the proposed and ongoing actions is limited to within the boundaries of Fort Hood.

### **A. Ongoing Activities**

Ongoing activities at Fort Hood consist of military training activities, endangered species management, recreation programs, prescribed fire, juniper control program, cattle grazing, brown-headed cowbird (*Molothrus ater*) control program, management for other sensitive species, and population monitoring and research. No substantial changes are proposed for these ongoing activities; however, because the proposed changes to the ESMP directly or indirectly involve these activities, they are discussed under this project description for inclusion in the “Effects of the Action” section of the biological opinion.

### **Maneuver Training**

Maneuver training exercises are conducted at all unit levels to ensure a combat ready fighting force. Training programs focus on units attaining and maintaining proficiency in collective tasks that support mission essential tasks. Units involved in the training process span all echelons from section to corps. III Corps' primary training focus at Fort Hood is the brigade level and below. Training exercises replicate combat conditions as closely as possible. Combat effects such as smoke, noise, and simulated nuclear, biological, and chemical conditions are integrated into every training event to condition units for operations in a difficult, stressful battlefield environment.

Units train for combat in a task-oriented manner. Trainers integrate combat, combat support, and combat service support elements to conduct multi-echelon, combined arms training. Combined arms training involves formations that include members of the entire fighting force. Commanders synchronize the activities of these forces within a battlefield framework that includes maneuver and operations within the deep, the close-in, and rear battle areas. Such exercises involve greater depth and rapidity of movement dimensions and, therefore, also incur greater demands for concurrent land use.

Maneuver training areas are located west, east, and southwest of the Live Fire Areas (Figure 1). Maneuver training areas constitute 53,300 ha (131,707 ac) or 61 percent of the entire installation. The West Range Maneuver Training Areas (Land Groups 4-6) provides excellent training opportunities for large armored and mechanized infantry forces. The training area averages seven to 10 km (4.3 to 6.2 mi) east to west and 30 km (18.6 mi) north to south. The area features a wide variety of terrain and vegetation characteristics that greatly enhance cross country, combined arms maneuver. Because of its large, contiguous size, this is the only maneuver area on Fort Hood capable of supporting brigade level operations.

The Northeast (Land Groups 1 and 2) and Southeast Range Maneuver Training Areas (Land Group 3) are divided by Belton Lake Reservoir. The northeast sector is heavily vegetated and cross-compartmentalized by terrain features, providing limited value as a mechanized maneuver area. The southeast sector provides more favorable terrain for mechanized units, but is only four to seven km (2.5 to 4.3 mi) north to south and 15 km (9.3 mi) from east to west. Because of

limited area, the Northeast and Southeast Range Maneuver Training Areas are best suited for unit assembly and logistical areas, artillery firing points, and company and platoon level mounted and dismounted training. Additionally, these eastern training areas support engineer, combat support, and combat service support training, and provide locations for amphibious and river crossing operations.

The Southwest Maneuver Training Area is not used for maneuver training due to its small size and isolated location. The Southwest Maneuver Training Area (Land Group 7) is separated from the main cantonment area by U.S. Highway 190. This training area includes many restricted areas, including Robert Gray Army Airfield and the Ammunition Supply Point. The Southwest Maneuver Training Area is used primarily for small mechanized unit and dismounted infantry training and for logistical sites.

### **Live-fire Training**

Fort Hood units train with the most modern and sophisticated weapon systems available. Fort Hood uses a Five-Year Range Modernization Program to manage upgrades and expansion of existing facilities and new construction projects to meet future training and evaluation requirements. Live-fire training facilities are located primarily in Live Fire Areas (LF) 80-93 and Permanent Dudded Area (PD94; Figure 1).

The Live Fire Areas and PD94 cover about 24,000 ha (59,305 ac) in the central portion of the installation, bounded on the east, west, and south by the East Range, West Range, and South Range roads respectively. Direct fire occurs inside these roads, and is directed towards the Artillery Impact Area and other target arrays. Indirect fire from artillery and Multiple Launch Rocket Systems is directed from numerous locations in surrounding maneuver areas. Much of the Live Fire Area provides a buffer zone for PD94 and has limited impacts from exploding ordnance. The Live Fire Areas provide training and evaluation facilities for all individual, crew-served, and major weapons systems, up to and including brigade live-fire. These Live Fire Areas are used by all active units assigned to III Corps and Fort Hood, as well as by attached units from the Army National Guard and the Army Reserve.

Modernized live-fire training facilities require continuous maintenance to maximize range design capability. Sensor devices must be serviced and cleared of concealing vegetation to ensure unimpaired operation. Target arrays must be visible at maximum engagement ranges. A program of range maintenance to routinely clear vegetation from target arrays and sensor devices is a critical component of range operation.

### **Aviation Training**

Fort Hood has one of the largest military aviation commands in the United States. The aircraft, primarily rotary-wing, are some of the most modern and sophisticated in the world. Aviation units on Fort Hood train at all echelons from individual through battalion/squadron.

The training tasks accomplished in the training areas (Figure 1) include all tactical maneuvers in accordance with each aircraft's aircrew training manual and the unit's standard operating

procedures. This includes nap-of-earth, contour, and low level flight. Fixed-wing aircraft of the Air Force and Air National Guard also conduct training missions in Fort Hood air space and use impact areas on the installation for weapons delivery practice.

Two major airfields are located on Fort Hood. The Hood Army Airfield is a 293 ha (724 ac) area located at the eastern end of the cantonment area. Hood Army Airfield is the primary airfield for rotary-wing air operations and has a 1,436 m (4,712 ft) runway. Robert Gray Army Airfield is an 867 ha (2,142 ac) area located at West Fort Hood with a 3,050 m (10,000 ft) runway. Several dirt landing strips are located on the installation for tactical air supply and support training.

Aircraft gunnery for AH-64 units is conducted on multi-purpose training ranges and PD94. However, the Dalton-Henson Range Complex (LF 80-82) is used most often for this training. Hellfire Missile Shots are conducted at Blackwell Multi-Use Range's Impact Area (PD94). Helicopter Door Gunnery is primarily conducted at Dalton Mountain Range or Crittender Range (LF 85-86). National Guard and Army Reserve units use the Dalton-Henson Range Complex for aviation training.

### **Operational Testing**

Fort Hood's large maneuver and Live Fire Areas, coupled with III Corps modernized force, provide excellent conditions for operational testing of various weapons, equipment, and doctrine. The U.S. Army Operational Test Command (OTC) is a tenant activity located at West Fort Hood directly involved in training, doctrine, and combat development of the products that soldiers use on a daily basis and will use on the future battlefield. Most OTC tests employ "user testing," allowing front-line soldiers to try out new equipment or concepts. The tests generally encompass activities similar to those described in the sections on maneuver, live-fire, and aviation training.

### **Controlled/Prescribed Burning**

Prescribed fire is a natural, economical, and effective management practice in some ecosystems. During the past 150 years in Texas, fire suppression practices have contributed substantially to the ecological imbalance of endangered species habitats. In many instances, properly applied fire can be one of the better tools to correct this problem. Fire presents a particular dilemma for the management of the BCVI and GCWA (collectively referred to as endangered species) on Fort Hood. Recovery times differ for GCWA and BCVI habitats after a stand-replacing fire. GCWA habitat that burns on Fort Hood generally regenerates first as BCVI habitat. Fire plays an important role in management of endangered species habitats on Fort Hood.

During extremely hot and dry conditions in late February 1996, approximately 2,728 ha (6,741 ac) of endangered species habitat were burned by wild fires on Fort Hood. This included about 2,313 ha (5,715 ac) of GCWA habitat and 415 ha (1,025 ac) of BCVI habitat. The GCWA habitat that burned substantially converted to BCVI habitat during the subsequent 2-5 years. New fire protection policies have been implemented on Fort Hood as a result of the 1996 fires and consultation with the Service.

Current prescribed fire policy emphasizes reduction of fuel loads in grasslands surrounding endangered species habitats on Fort Hood. Reduction of fuel loads mitigates the threat of wild fire damage in these habitats. Prescribed burns are managed through the Fort Hood Natural Resources Branch. Other objectives of the installation prescribed fire program are to reduce encroachment of Ashe juniper in all range sites, improve vegetation composition and improve wildlife habitats.

### **Juniper Cutting**

After the listing of the GCWA in May 1990, juniper cutting on Fort Hood was suspended temporarily following informal consultation with the Service. Since Ashe juniper is an essential component of the habitat for this endangered species, it was determined that juniper cutting could have a negative impact.

During the period 1997-2000, under an agreement with the NRCS, Fort Hood resumed mechanical clearing of juniper in old-field and other areas not occupied by GCWA. These control efforts were focused on juniper removal on West Maneuver Training Areas and resulted in clearing juniper from approximately 14,500 ha (35,830 ac) of old fields and other non-endangered species habitat areas. All control efforts and contracts were coordinated through the Fort Hood Natural Resources Branch to avoid impact on endangered species habitats. Control efforts were not allowed within a 100-m (328-ft) buffer around endangered species habitats.

### **Grazing**

Cattle grazing is permitted on Fort Hood under a lease agreement with the Central Texas Cattlemen's Association. The current lease extension expired September 15, 2004. This lease provides grazing opportunities on 80,000 ha (197,684 ac) of Fort Hood land. Negotiations are currently underway for a new lease. Under the new agreement, stocking rates are driven by the results of annual forage inventories. Grazing is deferred or stocking rate is reduced where forage production fails to meet thresholds that allow for training impacts and land management practices such as prescribed burning. The lease agreement requires the lessee not to impact endangered species, historical, archaeological, architectural, or other cultural features on the installation, and requires compliance with local, state, and federal water pollution regulations. A Supplemental Environmental Assessment (SEA) and 'Finding of No Significant Impact' for the Fort Hood grazing program was issued in January 2004. On February 22, 2005, an additional supporting document titled "Points of Agreement Regarding Methodology for Calculating Animal Units for Grazing at Fort Hood, Texas" was signed by representatives from the Army, Fort Hood, and the Texas Department of Agriculture. The methodologies outlined in this agreement will be used to determine the cattle stocking rate on the Fort based on available forage as discussed above, thus providing an adaptive management feature that will assist in minimizing impacts to listed species.

### **Cowbird Control Program**

Fort Hood conducts extensive operations to reduce numbers of brown-headed cowbirds on the installation. The objective of the control program is to maintain the incidence of cowbird



parasitism of BCVI nests below 10 percent annually, averaged over five-year periods. This program implements trapping and shooting activities that target feeding concentrations of cowbirds throughout the installation and cowbird individuals in endangered species nesting habitat. Summers and Norman (2004) provide details on the current implementation of the control program. In 2004, over 2,700 female brown-headed cowbirds were removed on Fort Hood during the GCWA/BCVI nesting season. Incidence of cowbird parasitism on BCVI nests in intensive study areas in 2004 was four percent.

## **Recreation**

The post is open to public hunting and fishing. Access is regulated by the Range Control Division, Area Access office with the cooperation of Morale Support Activities and the Natural Resources Branch. Over 80,500 ha (198,920 ac) are managed for fish and wildlife, including 100 surface ha (247 surface ac) of lakes and ponds, 88 km (54.7 mi) of rivers and permanent streams, and 85 km (52.8 mi) of shoreline access to Belton Lake. In recent years, the installation has provided 90,000 fisherman-days and 45,000 hunter-days annually. White-tailed deer, wild turkey, migratory waterfowl, northern bobwhite, and mourning dove are hunted during restricted seasons. Deer and turkey hunts are carefully controlled. Small game hunting with shotgun is available in accordance with State of Texas seasons and bag limits.

Various low-impact outdoor recreation activities take place at the Belton Lake Outdoor Recreation Area located adjacent to TA 36. These include a swimming beach, camping, boating, trail bicycling, and cottage use. Boy Scout Camps are located in TA 36 and LTA 203. Hiking and nature observation activities are also allowed on many parts of the installation and are coordinated through Range Control Division. Mountain bike riding is restricted to a designated trail system at Belton Lake Outdoor Recreation Area. No off-road recreational vehicle use is permitted anywhere on the installation.

## **Management of other Sensitive Species**

Fort Hood maintains an active program to monitor, manage, and protect sensitive natural resources and populations occurring on the installation. These include transient occurrence of endangered bald eagles and whooping cranes, a rare plant *Croton alabamensis*, several species of endemic karst invertebrates, and recently discovered new species of salamander, *Plethodon* sp.

The priority for management and protection of other sensitive species on Fort Hood is to minimize factors that could lead to future listing actions for these species. *Croton alabamensis* populations are visited annually to assess population status and monitor potential threats. At this time these locations are not disturbed by military training activities.

Fort Hood has an extensive network of karst features. In the 1990s extensive faunal surveys identified several endemic karst-associated invertebrates. Fort Hood implemented protective measures such as gating of caves to minimize human impacts on these populations. Surveys and mapping of caves are ongoing. Research has been conducted on populations status and effect of fire and depredation on these systems. Fort Hood is currently developing a formal karst management plan.

## **Population Monitoring and Research Programs**

Population monitoring programs on Fort Hood are established on the basis of adaptive management principles. Monitoring programs have been conducted on Fort Hood for both GCWA and BCVI since these species were listed. These programs have evolved over the years in response to new data requirements and management initiatives. Overall objective of the monitoring program is to determine population trends, demographic parameters, and effectiveness of management initiatives. Monitoring activities include intensive population and demographic data collection on selected intensive study areas, base-wide point counts and other targeted data collection activities. Details of the current monitoring program are found in The Nature Conservancy of Texas's 2004 Annual Report. Monitoring activities are assessed annually and adjusted as necessary to provide the best evaluation of population status and management practices.

Fort Hood also supports and hosts a variety of research efforts on endangered species populations on the installation. Fort Hood, the Army, and DoD support significant research programs to evaluate factors affecting endangered species populations on the installation including human disturbance, predator effects, noise impacts and habitat suitability. Many of these research efforts are currently in progress and results will be incorporated in future management approaches and policies.

Current information indicates that feral hogs have been increasing in abundance at Fort Hood and may influence the composition, succession, and quality of endangered species habitat. The extent of the effects feral hogs may have on endangered species habitat is unknown, but anecdotal evidence suggests that large populations of hogs could have both long and short term adverse impacts on endangered species. To address this problem, Fort Hood has recently begun controlling feral hogs through trapping and aerial shooting.

As a part of the endangered species population monitoring program, Fort Hood employs the use of helicopter over-flights to ensure compliance with training guidelines, observe the effects of training activity in endangered species habitat, control feral hogs, and monitor the presence and spread of oak wilt. Fort Hood's use of helicopter surveillance is an effective means of monitoring the available habitat, as well as providing aerial support for fighting fires that threaten habitat.

Fort Hood reports the status and results of these monitoring and research programs annually to the Service. Results are also presented at national symposia and through publication in peer-reviewed publications.

### **B. ESMP Revision**

Changes to the ESMP are proposed to better suit the Army's mission and incorporate the most current information regarding the status and distribution of the BCVI and GCWA at Fort Hood and the effects of military and other activities on these species. The proposed changes are: (1) modification of current fire management and protection policy within Live Fire Areas, (2) reduction of habitat area designated as "core" for BCVI and GCWA subject to Fort Hood

Endangered Species Training Guidelines, and (3) projected habitat loss due to facility construction and maintenance activities. These actions are described in further detail below.

## 1. Fort Hood Fire Management and Protection Policies

Fort Hood currently has a fire danger rating system to alert trainers when pyrotechnic operation should be limited or halted based on current (daily) weather and estimated moisture content of vegetation and soil. Details of this rating system are found in OPLAN 8-93, “Operation Brush Fire” and Fort Hood Regulation 350-40. These fire ratings are:

**Condition Green:** No restrictions on training. Troops may use pyrotechnics and incendiary munitions for training.

**Condition Amber:** Caution must be taken in use of pyrotechnics. Aerial flares are not to be used outside the impact area. Other pyrotechnics are to be used only in roadways, tank trails, in areas clear of vegetation, or in containers.

**Condition Red:** No pyrotechnics or incendiary munitions authorized for training purposes.

**Condition Red with Waiver:** Once a risk assessment is conducted by Range Control and the recommendation for training with waiver is approved by the Director, Range Control, specific restrictions are imposed on training units.

Currently, under all fire condition ratings, fires are reported to Range Control by military units or installation personnel. If the fires are within range fans where live-fire training is being conducted, units will cease firing until a fire risk assessment is conducted or control measures are implemented. Range Control will determine the location of the fire and risk to facilities, personnel, or sensitive resources such as endangered species habitats. If Range Control determines there is no risk to facilities or habitats, the fire will be allowed to burn. Typical examples are fires occurring in the permanently-duded impact area (PD94; Figure 1) where fires are extremely frequent and fuel loads are low. If a fire may risk endangered species habitat, Range Control will contact the installation Natural Resources Branch for an assessment of the risk based on proximity to high hazard areas, fuel load, topography and other parameters. If the fire risk to habitats is obviously high, Range Control may immediately implement fire control actions concurrent with notification of the Natural Resources Branch.

Under current procedures, fire control will be implemented under all fire condition ratings if a determination is made that endangered species habitat is at risk from a fire. Within the Live Fire Areas, the first response is usually by a contracted helicopter on standby for fire control. Under condition Red this helicopter is on 30-minute standby during 1100-1800 and two-hour standby during the rest of the day/night period. Other installation fire fighting assets are available for fire control as needed.

The proposed action would reduce requirements to conduct intensive fire suppression in Live Fire Areas during conditions Green and Amber. Fort Hood would establish a “let burn” policy

for range fires that occur during periods when Fire Danger Rating is Green or Amber. Under Green and Amber ratings, fires would be allowed to burn in all habitat areas within the Live Fire Area unless there is obvious threat to personnel or facilities or until such time as changing environmental conditions warrant implementing increased fire control procedures.

In order to minimize potential impacts to endangered species habitat resulting from the proposed revisions to the Fort Hood Fire Management and Protection Policies, Fort Hood proposes the following measures:

- Fort Hood will monitor effects of all fires on endangered species habitat occurring on the installation. Fort Hood will maintain records on the date and area of endangered species habitat affected, and report these data annually to the Service. Fort Hood will allow safe and sufficient access to Live Fire Areas by Natural Resource Branch personnel and contracted biologists to monitor BCVI and GCWA productivity, predation, and population trends in these areas.
- Fort Hood will emphasize use of preventative prescribed fire to maintain blacklines near habitat areas annually. Fort Hood will employ firebreaks in association with endangered species habitats to reduce fire risk.
- Fort Hood will continue to use aerial support (helicopter) for fighting fires that pose a threat to important GCWA habitat areas.

Additionally, Fort Hood would implement habitat management prescriptions to maintain installation population goals for both BCVI and GCWA. The Fort would maintain suitable habitat to support 1,000 adult BCVI males and 2,000 adult GCWA males at maximum densities. GCWA habitat that burns on Fort Hood typically regenerates in the short-term as BCVI habitat. BCVI habitat on Fort Hood that is not periodically disturbed over time will become unsuitable for BCVI occupancy and may ultimately regenerate to GCWA habitat. The temporal and spatial pattern of fires and other disturbance creates a dynamic relationship between the availability of BCVI versus GCWA habitat.

This relationship between disturbance regimes and habitat suitability presents a challenge to installation natural resource managers to determine when and where habitat management prescriptions should be implemented to support the installation's overall endangered species population goals. Under the proposed action, Fort Hood would determine criteria and identify areas suitable for maintenance as BCVI habitat. Management prescriptions to maintain adequate areas of suitable BCVI habitat would rely first on passive management activities such as habitat creation and maintenance through the "let-burn" policy and mechanical disturbance from training activities. Secondly, active management practices such as prescribed burns and mechanical clearing would be implemented as necessary to maintain installation population goals for BCVIs (see Ongoing Activities section).

## 2. Reduce Area Designated as ‘Core’ Habitat

Currently, 4,184 ha (10,339 ac) of BCVI habitat and 14,879 ha (36,767 ac) of GCWA habitat are designated as “core” habitat. Under this designation, training activity in habitats designated as core is subject to conditions of the Fort Hood Endangered Species Training Guidelines (Appendix A). These guidelines prohibit fixed activities greater than two hours duration in designated core habitats during the period 1 March through 31 August. Vehicle traffic is restricted to existing roads and trails in core habitats.

Under the proposed action, core habitat designation would be removed from all 4,184 ha (10,339 ac) of BCVI habitat, and core habitat designation for GCWA would be reduced to 3,861 ha (9,541 ac). For GCWA, core habitat designation would be implemented in habitats occurring in the East Ranges (land groups 2 and 3) as shown in Figure 2. Core habitats under this proposed action would constitute all GCWA habitats east of a water pipeline and north of Belton Lake, and habitats north of North Nolan Road and south of Belton Lake. The latter core habitat area includes the Belton Lake Outdoor Recreation Area and a long-term GCWA intensive monitoring study plot. Additionally, the time period for implementing Level 2 restrictions (Appendix A) would be reduced to 1 March through 30 June.

In accordance with principles of adaptive management, Fort Hood would implement or restructure monitoring programs to assess long-term effects, if any, of this action on endangered species populations and habitats on the installation. Designation of habitat as “core” or “non-core” is not a good indicator of the duration, frequency or intensity of training activity at any particular location under these designations. Because any level of transient activity is still allowed in core habitats, locations within these areas may still be subject to a high level of training activity. Conversely, depending on the training footprint, habitats designated as non-core may be subject to very little training activity at any particular location. For these reasons, monitoring programs to determine the relationship between training activity and long-term population and habitat trends would require some measure or index of training activity in association with study populations. Currently, an analysis is being conducted to assess historical differences in endangered species populations between currently designated core and non-core habitats. These analyses will be provided to Fort Hood prior to the 2005 breeding season for consideration in implementing programs to monitor long-term effects of training activity on endangered species populations and habitats.

Other DoD and Army research programs that directly address effects of military training activities on endangered species populations are currently ongoing or programmed for implementation. Although Fort Hood has no control or funding authorization for these research programs, the installation does provide technical review, site access and logistical support for these activities. Under this proposal, Fort Hood would continue to support execution of these research activities and would ensure that results are provided to the Service for review.

Off-site conservation and protection of endangered species habitats also provides an opportunity to offset potential effects of mission activities on Fort Hood. In FY04, Fort Hood provided funds in support of voluntary short-term habitat management through the Leon River Restoration Project, and funding to support permanent conservation easements and long-term Safe Harbor

agreements through The Nature Conservancy and Environmental Defense. Fort Hood will continue to collaborate with other governmental and non-governmental agencies to identify off-site opportunities for habitat conservation and protection, particularly those covenants that will contribute toward species recovery goals as defined under the Act. Fort Hood will provide logistical and financial support for these activities contingent upon availability of funds.

### 3. Construction and Range Improvements.

Currently, construction and range improvement projects on Fort Hood that potentially eliminate endangered species habitat require individual consultations with the Service. Under the proposed action a programmatic incidental take would be established to cover anticipated take of habitat over a five-year period due to military construction and range improvement activities.

Master planning documents for major construction over the next five years anticipate a number of multi-purpose range upgrades, additional targetry, urban assault training facilities, and habitat alterations for tactical training land improvements such as tank trail construction and brush clearing for visibility. Table 1 shows examples of the types of projects anticipated under the current five-year master planning cycle. Current estimates are that endangered species habitat loss due to these activities during the next five-year master planning cycle would not exceed 325 ha (803 ac). Projected estimates are that approximately 2/3 (217 ha [536 ac]) of this total area would be GCWA habitat with the remaining habitat loss (108 ha [267 ac]) comprised of BCVI habitat.

**Table 1. Examples of anticipated construction and range improvement projects during the next five-year planning cycle at Fort Hood, Texas. Refer to Figure 1 for action area locations.**

Project Title	Proposed Action Areas
Killeen-Fort Hood Joint Military/civilian Use Airport expansion	West Fort Hood (WFH)
Browns Creek Digital Multipurpose Range Complex	LF 83
Lone Star Range Upgrades	LF 82
Brookhaven Scout Qualification Range	LF 88
Dalton/Henson Mountain Aviation Qualification Range	LF 80, 81, 82
Sugarloaf Digital Range Complex	LF 88, 89
Blackwell/Pilot Knob Digital Multipurpose Range	LF 90
Military Operations Urban Terrain/combined arms Combat Training Facility	LF 92, 93
Construction/Replacement of Primary and Secondary Tank Trails	Training Areas (TA)

Most of the anticipated construction and range improvement projects such as those shown in Table 1 are located within or immediately adjacent to Live Fire Areas (Figure 1). The range

complex projects are examples of these. Examples of projects outside the Live Fire Areas include the Killeen-Fort Hood airport expansion and construction of tank trails. It is not anticipated that the entire project area for any of these projects would be completely within endangered species habitats, but it is anticipated that some level of habitat loss may be associated with these project actions.

The anticipated programmatic take under this proposal is based on historical requirements for similar projects, the likely footprints of projects in more advanced planning stages, and the level of anticipated construction activity. The actual take may not reach levels established under this programmatic proposal. All projects are subject to environmental review early in the planning stage to minimize impacts on sensitive natural and cultural resources. This planning requirement may result in take below the maximum anticipated levels. Likewise, unforeseen mission requirements may require proposed projects that could exceed take anticipated under this programmatic proposal. In this case, Fort Hood would need to enter into consultation with the Service for any projects that would exceed programmatic take anticipated under this proposal.

Improved and new tank trail construction may allow increased access to endangered species habitats (see Effects of the Action section). In Fort Hood's review and revision of monitoring programs, consideration would be given to determining changes in vehicle access and use of endangered species habitats.

## II. Status of the Species

The current list of federally threatened, endangered, and candidate species that are known to occur, or have been documented in Bell and Coryell Counties is presented in Table 2. Candidate species are not afforded federal protection under the Endangered Species Act; however, the Service recommends that potential impacts to these species be considered during project planning.

<b>Table 2. Federally listed species known to occur in Bell and Coryell Counties, Texas.</b>			
<b>Common Name</b>	<b>Scientific Name</b>	<b>Status</b>	<b>County</b>
black-capped vireo	<i>Vireo atricapilla</i>	Endangered	Bell, Coryell
golden-cheeked warbler	<i>Dendroica chrysoparia</i>	Endangered	Bell, Coryell
whooping crane	<i>Grus americana</i>	Endangered	Bell, Coryell
bald eagle	<i>Haliaeetus leucocephalus</i>	Threatened	Bell
Salado salamander	<i>Eurycea chisholmensis</i>	Candidate	Bell
smalleye shiner	<i>Notropis buccula</i>	Candidate	Bell

Currently, there are no known populations of the Salado salamander or smalleye shiner on Fort Hood. Additionally, habitat for these species does not occur within the action area.

Whooping cranes and bald eagles are transient on Fort Hood with documented occurrences along the shoreline and flood plain of Belton Lake. Fort Hood management policy for bald eagles is to

minimize disturbance from low-level helicopter flights and other aviation assets. When bald eagles are observed in autumn the Fort Hood air-space coordinator is notified and a no-fly zone is implemented. This zone is located near Belton Lake in Land Group 2 and LTA 115. Flight restrictions are lifted when no bald eagles have been observed for a period of two weeks.

Observations of whooping cranes are uncommon on Fort Hood. In the event that this species is observed on the installation, the installation Director of Operations, Range Control Division, will be notified and training activities will be suspended in proximity to whooping cranes until they have departed installation lands.

Under the proposed action the current protection and reporting policies for these species would remain in affect. For these reasons, it is anticipated that the proposed action is not likely to affect the bald eagle or whooping crane, and therefore, these species are not considered further in this biological opinion.

Two federally listed endangered species that do occur in the action area and that may be affected by the proposed action are the BCVI and GCWA. The BCVI was listed by the Service in 1987 (52 FR 37420-37423). The Service emergency listed the GCWA on May 4, 1990 (55 FR 18844) and published a final rule on December 27, 1990 (55 FR 53153-53160). Critical habitat has not been designated for either of these species. The recovery plans for the BCVI and for the GCWA were finalized on September 30, 1991, and September 30, 1992, respectively.

**Black-capped Vireo** - The BCVI is an 11.4 centimeter (4.5 inch) long, insect-eating songbird. Mature males are olive green above and white below with faint greenish-yellow flanks. The crown and upper half of the head is black with a partial white eye-ring. The iris is brownish-red and the bill black. The plumage of the female is duller than the male. Females have a dark slate gray head (USFWS 1991).

BCVIs arrive in Texas from mid-March to mid-April, while BCVIs in Oklahoma arrive approximately 10 days later. They nest from Oklahoma south through central Texas to the Edwards Plateau, then south and west to central Coahuila, Mexico. A pair will most often be monogamous for the breeding season, selecting a nest site together, while the female completes nest construction in two to three days. BCVIs suspend their nests in the forks of shrubs in dense underbrush, from 0.3 to 0.9 meters (1 to 6 feet) above the ground; most nests are found around one meter (3.3 feet) above ground. Three to four eggs are usually laid in the first nesting attempt, but later clutches may only contain two to three eggs. The first egg is usually laid one day after nest completion, with one egg being laid each subsequent day. Incubation takes 14 to 17 days, and is shared by both the male and female. BCVI chicks are fed by both adults as well, and leave the nest 10 to 12 days after hatching (Campbell 1995).

Although BCVI habitat throughout Texas is quite variable with respect to plant species, soils, and rainfall, all habitat types have a similar overall appearance. BCVIs typically inhabit shrublands and open woodlands with a distinctive patchy structure. The shrub vegetation generally extends from the ground to about 1.8 meters (6 feet) above ground and covers about 30% to 60% of the total area. Open grassland separates the clumps of shrubs. In the eastern portion of the BCVI's range, the shrub layer is often combined with an open, sparse to moderate



tree canopy. In the Edwards Plateau and Cross Timbers regions, common plants in BCVI habitat include Texas red oak (*Quercus buckleyi*), Lacey oak (*Quercus glaucoides*), white shin oak (*Quercus sinuata* var. *breviloba*), Durand oak (*Quercus durandii*), Plateau live oak (*Quercus fusiformis*), Texas mountain laurel (*Sophora secundiflora*), evergreen sumac (*Rhus virens*), skunkbush sumac (*Rhus trilobata*), flameleaf sumac (*Rhus lanceolata*), Texas redbud (*Cercis canadensis* var. *texensis*), Texas persimmon (*Diospyros texana*), honey mesquite (*Prosopis glandulosa*), and agarita (*Berberis trifoliolata*). Densities of Ashe junipers (*Juniperus ashei*) are usually low. In the western Edwards Plateau and Trans-Pecos regions, BCVIs are often found in canyon bottoms and slopes containing plants such as sandpaper oak (*Quercus pungens*), white shin oak, Texas kidneywood (*Eysenhardtia texana*), Mexican walnut (*Juglans microcarpa*), fragrant ash (*Fraxinus cuspidata*), mountain laurel, and guajillo (*Acacia berlandieri*). BCVI habitat is related to disturbance, and thought to have been created by natural disturbances (e.g., fires) in areas with rocky substrates and shallow soils, which generates successional habitat (Koloszar et al. 2000).

Threats to the BCVI include habitat loss and degradation due to development, habitat succession, poor grazing practices, brown-headed cowbird (*Molothrus ater*) parasitism, and low reproductive success. Throughout the Hill Country, much of the BCVI's habitat has been destroyed or degraded by residential and commercial development, grazing practices, and fire suppression.

BCVIs may live for more than five years, and usually return year after year to the same territory. The birds begin to migrate to wintering grounds on Mexico's western coast in July, and are gone from Texas by mid-September (Campbell 1995).

**Golden-cheeked Warbler** - The GCWA is a small, insectivorous songbird, 11.4 to 12.7 centimeters (4.5 to 5 inches) long, with a wingspan of about 20 centimeters (7.9 inches). The male has a black back, throat, and cap, and yellow cheeks with a black stripe through the eye. Females are similar, but less colorful. The lower breast and belly of both sexes are white with black streaks on the flanks (USFWS 1992).

The GCWA nests in the juniper-oak woodlands of the Texas Hill Country and winters in the pine-oak woodlands of southern Mexico, Guatemala, Honduras, and Nicaragua. Its entire nesting range is confined to 33 counties in central Texas. Typical nesting habitat is found in tall, dense, mature stands of Ashe juniper mixed with deciduous trees such as Texas red oak, Lacey oak, white shin oak, live oak, post oak (*Quercus stellata*), Texas ash (*Fraxinus texensis*), cedar elm (*Ulmus crassifolia*), hackberry (*Celtis occidentalis*), bigtooth maple (*Acer grandidentatum*), sycamore (*Platanus occidentalis*), Arizona walnut (*Juglans major*), escarpment cherry (*Prunus serotina*), and pecan (*Carya illinoensis*). This type of woodland is often found in relatively moist areas such as steep-sided canyons and slopes. GCWAs are also occasionally found in drier, upland juniper-oak, i.e., live oak, post oak, blackjack oak (*Quercus marilandica*) woodlands over flat topography. Although the composition of woody vegetation may vary from place to place, Ashe juniper, which is necessary for nest construction, is always present.

The males arrive in central Texas in early March and begin to establish breeding territories, which they defend against other males by singing from visible perches within their territories. The females arrive a few days later but are more difficult to detect in the dense woodland habitat.

Usually three or four eggs are laid. The average nest height is five meters (16.4 feet) above ground. Eggs are generally incubated in April and, unless there is a second nesting attempt, nestlings fledge in May to early June. Migration south to the wintering grounds occurs in July and early August.

The primary threats to the GCWA are habitat loss and urban encroachment. Other factors include the loss of deciduous oaks (used for foraging) to oak wilt, nest parasitism by brown-headed cowbirds, and predation and competition by blue jays (*Cyanocitta cristata*) and other urban-tolerant birds (USFWS 1992).

### **III. Environmental Baseline**

#### **A. Description of the action area**

Fort Hood dates to 1942 when the Army established Camp Hood to prepare soldiers for tank destroyer combat during World War II. Renamed Fort Hood, it became a permanent installation in 1950. Various armored divisions have been assigned to Fort Hood since 1946.

Fort Hood is the only installation in the United States currently assigned two divisions. The installation provides the infrastructure and training lands for the 1st Cavalry Division and the 4th Infantry Division (Mech), III Corps Headquarters and its combat aviation assets, combat support, and combat service support units. With increased emphasis on force structure changes and Base Realignment and Closure initiatives, Fort Hood will likely remain the largest active U.S. installation in terms of assigned personnel. Total assigned personnel authorization is approximately 50,000 soldiers.

Fort Hood encompasses approximately 87,890 ha (217,180 ac) in Bell and Coryell Counties in central Texas. It lies at the northern extent of the Edwards Plateau and entirely within the Lampasas Cut Plains physiographic region and Grand Prairies Land Resource Zone. The Lampasas Cut Plains is typically vegetated with oaks such as Texas red oak, live oak, and white shin oak on the rocky Edwards limestone summits of small divides (Diggs et al. 1999). On large divides, areas of deeper soil typically support the westward extension of the Washita Prairie (Hayward et al. 1992). On the chalky thin soiled slopes derived from the underlying Comanche Peak limestone, white shin oak, sumac species, and Ashe juniper may be seen; these dry rocky areas have a distinctly desert-like microclimate (Hayward et al. 1992) and thus support plants with xerophytic adaptations. Below these slopes, on benches in valleys or on the summits of uplands lacking caprock, extensive areas of prairie can be found on the clay soils derived from the Walnut formation where it is exposed (Diggs et al. 1999). The basal Trinity Group sands (Paluxy, Antlers, Twin Mountains-Travis Peak) underlying the Walnut formation developed typical Cross Timbers vegetation such as post oak and blackjack oak (Hill 1901).

The topographic diversity and deeply cut streams found in various parts of the Lampasas Cut Plain provide important microhabitat variation. In particular, the diverse microhabitats allow the northward extension of many species otherwise found primarily on the Edwards Plateau. Some plants that were traditionally considered Edwards Plateau endemics can be found in the

Lampasas Cut Plain. These include big-tooth maple, plateau gerardia (*Agalinis edwardsiana*), wild mercury (*Argythamnia aphoroides*), Wright's milk-vetch (*Astragalus wrightii*), plateau false nightshade (*Chamaesaracha edwardsiana*), scarlet clematis (*Clematis texensis*), Lindheimer's silktassel (*Garrya ovata* var. *lindheimeri*), plateau milkvine (*Matelea edwardsensis*), Lindheimer's muhly (*Muhlenbergia lindheimeri*), devil's-shoestring (*Nolina lindheimeriana*), Heller's marbleseed (*Onosmodium helleri*), Lindheimer's rock daisy (*Perityle lindheimeri*), escarpment cherry, turnip-root scurfpea (*Pediomelum cyphocalyx*), plateau spiderwort (*Tradescantia edwardsiana*), Colorado Venus'-looking-glass (*Triodanis coloradoensis*), Lindheimer's crownbeard (*Verbesina lindheimeri*), and twisted-leaf yucca (*Yucca rupicola*).

Data obtained from the Army's Land Condition Trend Analysis (LCTA) Program at Fort Hood indicate that the installation is divided mainly into perennial grassland (65 percent) and woodland (31 percent) community types (Tazik et al. 1992), with relatively little shrubland. Most of the grasslands exhibit a dense or closed vegetative cover (83 percent). As a result of a history of grazing and military activity, the installation's grasslands are dominated by Texas wintergrass (*Stipa leucotricha*) (29 percent) and prairie dropseed (*Sporobolus heterolepis*) (18 percent), with little bluestem (*Schizachyrium scoparium*) grasslands comprising only nine percent of the grassland area (Tazik et al. 1993). Broadleaf woodlands comprise about 39 percent of LCTA woodland sites and typically are dominated by oaks. Coniferous and mixed woodlands comprise 61 percent and are dominated by Ashe juniper or a mixture of juniper and various oaks.

Elevation ranges from 180 m to 375 m (590 to 1,230 ft) above sea level with 90 percent of the area below 260 meters (853 ft). Higher elevations occur on the western portions of Fort Hood and the lowest at the Belton Lake shoreline adjoining the installation on the east. Surface water drains mostly in an easterly direction. Most slopes are in the two to five percent range. Lesser slopes occur along flood plains, while slopes in excess of 45 percent occur as bluffs along flood plains and as side slopes of mesa-hills.

## **B. Status of the species within the action area**

### **Black-capped Vireo**

Monitoring and research activities for BCVI on Fort Hood were initiated in 1987 and continue to the present. Research and conservation efforts include an inventory and monitoring program, remote camera studies of nest depredation and assessment of training activities in habitat, a habitat restoration program, and a cowbird control program. Currently, intensive study plots are established at four sites on the installation.

Based on an installation-wide survey conducted in 2002 and 2003, the current estimate of suitable BCVI habitat on Fort Hood is 6,967 ha (17,216 ac) (Cimprich 2003, Figure 2). This total habitat area does not include the 4.1 ha (10.0 ac) of habitat occurring on Fort Hood lands that are being transferred to Texas A&M University. Approximately 90 percent of suitable BCVI habitat is estimated to be occupied by BCVIs (Cimprich 2003).

Distribution of habitat and populations on Fort Hood is dependent on historical disturbance patterns that result in the preferred habitat structure. Currently, major concentrations of habitat and populations are found in the Live Fire Areas where fire is the predominant disturbance factor, in the west ranges where a combination of fire and mechanized military training has created habitat, and in Land Groups 1 and 2 where fire in 1996 and mechanical range clearing in the mid 1980s has created extensive habitat. BCVI habitat on Fort Hood is typically located on steep slopes and mesa tops and is embedded in a landscape matrix of GCWA habitat and open grassland/savannah.

During the 2002-2003 installation-wide survey, 1,847 adult BCVI males were observed (Cimprich 2003). In intensive study areas with known densities, these surveys detected approximately 25 percent of the known population. If this calibration is extrapolated to the entire installation, this would result in a population estimate of 7,388 territorial males; however, the precision of this estimate is unknown and therefore should be considered with caution (Cimprich 2003). An installation goal of habitat carrying capacity to support 1,000 adult BCVI males at maximum densities has been established based on population viability analyses (Hayden et al. 2001). The observed and estimated populations on Fort Hood exceed this goal by a factor of two to seven times.

Demographic data for 2003 (Cimprich 2003) indicated the daily probability of nest survival was lower in the egg-laying stage than during incubation or the nestling stage, and the probability of survival from the beginning of egg-laying to the end of the nestling period was 23 percent. No trend in nest survival over the past seven years was detected, although daily survival in the incubation period was lower in 2003 than in 2002. Despite relatively high nest predation and low nest success, 58 percent of territorial males succeeded in producing  $\geq 1$  fledgling. Successful nests produced a mean of 3.25 fledglings and territorial males produced a mean of 1.60 fledglings over the entire season.

### **Golden-cheeked Warbler**

Monitoring and research activities for the GCWA on Fort Hood were initiated in 1991 and continue to the present. Research and conservation efforts include assessment of population trends, demographic and reproductive monitoring, habitat selection studies, habitat fragmentation and wildfire studies, and population viability analyses. Intensive study plots are currently established at three sites on the installation.

Currently, it is estimated that approximately 21,422 ha (52,935 ac) of suitable GCWA habitat occur on Fort Hood (Hayden et al. 2001) (Figure 2). This total habitat area does not include the 70 ha (173 ac) of habitat occurring on Fort Hood lands that are being transferred to Texas A&M University. GCWA occurrence has been documented in all training areas that have suitable habitat, including the Live Fire Area. An analysis of point count survey data show the abundance of GCWAs on Fort Hood has increased from 1992 to 2003 (Peak 2003). Using GCWA densities from intensively studied areas, the population on Fort Hood is estimated to range from 2,901 to 6,040 singing males. Observed density in 2003 on intensive study plots was 0.21 males/ha, which extrapolated to all available habitats would produce an estimate of 4,514 territorial males (Peak 2003).

Pairing success in 2003 was 82 percent and was similar to other years during 2000-2003. Daily survival probability of nests during 2000-2003 ranged from 0.94 to 0.97 and was not significantly different among years. Nest success (percent of males fledging at least one young) during the 2000-2003 period ranged from 23 to 40 percent.

The goal of Fort Hood for a minimum viable population is to maintain suitable habitat to support 2,000 males at maximum density (Hayden 2001). Current population estimates exceed this goal by a factor of two to six. Analyses by Peak (2003) indicated that productivity and nest success of Fort Hood GCWA populations are adequate to maintain stable population growth, and in some years may exceed requirements.

#### **IV. Effects of the Action**

The direct and indirect effects of the proposed action involve all activities related to the operation and maintenance of a military installation and other non-military related activities including research and management of federally listed species. The proposed action is described as Ongoing Activities and ESMP revisions, which overlap in scope and cannot be easily separated for an effects analysis without needless redundancy. This section categorizes the potential effects of the proposed action for convenience and references other discussions of effects where necessary to avoid repetition.

##### **A. Ongoing Activities**

Direct and indirect effects to the BCVI and GCWA as a result of military and other activities at Fort Hood are anticipated as these activities occur within and adjacent to endangered species habitat in the action area. These anticipated effects include habitat loss, disruption of breeding behavior such that productivity is affected, and loss of nests and/or young. Potential effects related to human disturbance on avian populations have been reviewed and reported in several studies (e.g., Wilcove 1988, Riffell et al. 1996, Gutzwiller and Hayden 1997, Gutzwiller et al. 1998). Habitat loss due to ongoing activities is largely a result of wildfire within the Live Fire Area. Wildfire may also impact endangered species habitat outside of the Live Fire Area, as in the 1996 fire that burned approximately 2,313 ha (5,715 ac) of GCWA habitat and 415 ha (1,025 ac) of BCVI habitat. The effects of Live Fire Training on endangered species are discussed further under “ESMP Revisions” in this section. Other effects of Ongoing Activities are discussed below.

##### **Black-capped Vireo**

Maneuver training activities are anticipated to affect the BCVI where its habitat is distributed in the west ranges and Land Groups 1 and 2. Military training would be infrequent in BCVI habitat that occurs on steep slopes due to limited access. However, BCVI habitat located on flat areas is accessible to vehicles and personnel and provides a degree of tactical cover that is desirable in training scenarios. BCVI nests are susceptible to direct destruction due to their proximity to the ground and shrub substrate. Since BCVIs use relatively ephemeral, patchily distributed habitats, they are likely adapted to a relatively high level of habitat fragmentation.

Off-road vehicle use and military bivouacs (e.g., tactical operations centers) have been observed in some BCVI habitats since access restrictions were lifted in some areas as a result of implementation of the installation ESMP in 2000. However, observed direct and indirect effects on BCVI in these habitats have been minimal in sites that are intensively monitored. In the last two years, five incidents were reported where military personnel were in close proximity to active nests and were requested to move. In one of these cases, military personnel had put sleeping cots to dry on top of a shrub with an active nest. These personnel were made aware of the nest presence and removed their equipment from the area. This nest remained active subsequent to this event. In another case, it is believed vehicle and personnel in the vicinity of an active nest led to its abandonment. In this case, the banded adult male associated with this nest was not observed again in the area. Another nest was lost in the building stage when a wheeled military vehicle apparently backed over the nest bush. The adult pair subsequently successfully re-nested in the same area. These two documented nest losses in the last two years are out of 402 monitored BCVI nests during this period. Habitat disturbance due to off-road vehicle activity in habitats in the form of crushed or damaged shrubs has been observed. This damage is typically localized with limited alteration of the overall habitat matrix.

Several factors of BCVI biology and habitat preference ameliorate potential effects of disturbance from military activity in habitats. Preliminary physiological and behavioral data collected by T. Hayden on Fort Hood suggests BCVIs may be relatively tolerant of human presence. In 2001 and 2002, physiological stress was assessed in white-eyed vireo (*Vireo griseus*) populations in core BCVI habitat and in unprotected habitat. White-eyed vireos are a closely related con-generic to BCVIs, have similar nesting characteristics, and are locally sympatric with BCVI territories. Measures of corticosterone, the indicator stress hormone in birds, was not significantly different between individuals sampled in protected versus unprotected habitats in 2001 and 2002, suggesting that this species is not chronically stressed in unprotected habitats above levels observed in protected habitats (Hayden, unpublished).

Training activity at any particular site is relatively infrequent and typically of short duration. Observed training patterns at Fort Hood are similar to those studied at Fort Stewart, Georgia, where a relative few sites received the majority of training activity and the majority of this activity was road/trail transit by wheeled vehicles (Hayden et al. 2002). It is expected that BCVIs at any specific locality would have infrequent exposure to military activity of limited duration. A limited number of sites on Fort Hood are known to have a higher probability of military activity relative to the installation as a whole.

Harassment of breeding BCVIs from disturbance due to training activity is most likely to occur from fixed activities within habitat. Fixed activities include establishment of artillery firing points, tactical operation centers, or other field support facilities. Tactical doctrine dictates that artillery units should limit their exposure at any one location. In most cases these units would perform their mission function at the site and depart the location within a few hours to generally no more than 48 hours. Tactical operation centers and field support facilities operate in conjunction with field training exercises that typically run for no more than a two week period. Duration of these field facilities at any one site is typically limited to a few days at most.

BCVIs have a high incidence of double and even triple brooding and repeated re-nest attempts after nest failure. Adult males have been documented to initiate as many as seven nesting attempts during a season at Fort Hood. Impacts to nests and disruption of breeding behavior may affect BCVI productivity depending on the timing of impacts within the breeding season. For example, females that may have been capable of double brooding may only successfully brood once if an impact to the first nesting attempt occurs at a point in the season so as to not allow for two subsequent broods. Alternatively, the loss of a nest or nesting attempt early in the season may not result in an overall loss of productivity due to the species ability to re-nest if necessary.

It should also be noted that extensive areas of habitat at Fort Hood are apparently maintained due to mechanical disturbance by training activity. Approximately 8.1 percent (567 ha [1,401 ac]) of BCVI habitat at Fort Hood is attributed to and maintained by mechanical disturbance from training activity. In the West Ranges, where currently there are no training restrictions, habitats maintained by mechanical disturbance comprise approximately 16.4 percent of BCVI habitat. Due to the earlier successional character of BCVI habitat at Fort Hood, regeneration after physical disturbance is quite rapid. In most cases, only excessive erosion would potentially preclude regeneration after disturbance. BCVI habitats on Fort Hood that are most likely to be disturbed are predominantly flat with limited erosion potential.

### **Golden-cheeked Warbler**

Studies of non-military activities have documented potential effects of human-related activities on the GCWA. Several studies have documented adverse impacts on GCWAs due to urbanization attributed to increased habitat fragmentation, edge, and avian predators (e.g., Sexton 1991, Coldren 1998, Fink 1996, Arnold et al. 1996, Engels 1995). These studies indicate that GCWAs select against habitat edge and reproductive success is reduced in proximity to edges. Studies at Fort Hood in 1995-96 indicated that mating success was lower in more fragmented habitats on the installation (Maas 1998).

GCWA habitat may be directly impacted by off-road vehicle traffic through the destruction or damage of trees. These impacts are likely small in size (limited to individual trees) and localized for the following reasons. Off-road vehicle traffic is largely precluded in GCWA habitat either by topography (steep slopes) and/or density of the associated vegetation. Wheeled vehicles would be unable to traverse through most GCWA habitat. Tracked vehicle transit through habitat is uncommon due to potential damage to the vehicles. Also, transit through vegetation that leaves obvious tracks does not conform to tactical doctrine, which dictates that such activity would increase detection by opposing forces and is therefore inadvisable. No loss of habitat or direct damage to nests due to military activity has been observed in either designated Core or non-core GCWA habitats since monitoring was initiated in 1991.

Fixed activities associated with field training exercises are also uncommon in GCWA habitat due to topography and vegetation density. Examples of fixed activities include artillery firing points, tactical operations centers, communications centers and field medical units. Facilities associated with these activities include personnel, vehicles and trailers, tent facilities, and electrical generator use. The area occupied by these activities is typically < 10 ha (25 ac). GCWA habitat

is not suitable for these field training facilities which require some degree of open space that is not characteristic of the species' habitat.

### **Controlled/Prescribed Burning**

The prescribed burning program at Fort Hood would help reduce fuel loads in proximity to endangered species habitat. This will have the effect of reducing the potential for uncontrolled wildfire in endangered species habitats. Fire would also be used to remove encroaching juniper from BCVI habitat within military training areas. The overall long term effects of prescribed fire would be beneficial to the BCVI and GCWA. Adverse effects, if any, would occur as loss of habitat and likely be short term.

### **Juniper Cutting**

Juniper cutting is currently not conducted in GCWA habitats and would not be conducted under the proposed action. Juniper cutting to control encroachment in old fields would not affect endangered species populations on Fort Hood. Selective removal of second-growth juniper from BCVI habitat with a tree shear is conducted primarily in the western maneuver area, where mechanical effects of military training, rather than fire, is the primary disturbance mechanism. This technique for habitat management, particularly when coupled with a cool season prescribed burn under mild conditions, is useful for habitat enhancement in areas where a stand replacement fire is not appropriate, and will continue to be used as a tool. This selective removal of juniper conducted outside of the breeding season is anticipated to have an overall beneficial effect to the BCVI. Short term effects to habitat would be insignificant.

### **Grazing**

Currently, negotiations for a new cattle grazing lease at Fort Hood have not been finalized. The new lease agreement would be consistent with the grazing SEA and the "Points of Agreement Regarding Methodology for Calculating Animal Units for Grazing at Fort Hood, Texas" dated February 22, 2005 (grazing agreement).

Cattle may directly affect BCVI habitat by browsing on preferred nesting shrubs, but these effects are anticipated to be insignificant, and would only be considered where lack of management allowed overgrazing in BCVI habitat (USFWS 1991, Campbell 1995). The majority of potential effects related to grazing are indirect, involving the relationship of grazing activity and the presence of the brown-headed cowbird (Summers and Norman 2004). Studies at Fort Hood have demonstrated an association of brown-headed cowbird feeding sites with areas of cattle grazing (Koloszar and Horne 2000). Parasitism by brown-headed cowbirds has been shown to significantly reduce nest success and productivity of BCVIs on Fort Hood (Hayden et al. 2000). However, cowbird control efforts at Fort Hood have significantly reduced the effects of cowbird parasitism that might be associated with cattle grazing at Fort Hood (see Cowbird Control Program below).

Changes in the stocking rate would be based upon current forage inventories, the grazing SEA, and the grazing agreement, which provide adaptive management practices conducive to



endangered species habitat management. The indirect effect of cowbird parasitism, while influenced by the grazing program, is greatly minimized through the cowbird control program. The objective of the cowbird control program is to maintain an annual parasitism rate for the BCVI below 10 percent (averaged over five-year periods) regardless of the cattle stocking rate. The grazing program is not expected to result in take of endangered species provided the allowed stocking rate is based upon current forage inventories and the cowbird control program maintains the parasitism goal.

### **Cowbird Control Program**

The cowbird control program is likely the single most important factor in the observed increases in BCVI and GCWA populations at Fort Hood. Data from Fort Hood shows that without cowbird control, incidence of parasitism of BCVI nests was 90-100% (Tazik et al. 1992). The cowbird control program has reduced the incidence of cowbird parasitism installation-wide, averaging less than 10 percent annually (Hayden et al. 2000, Cimprich 2003). The incidence of cowbird parasitism has a strong negative correlation with BCVI reproductive success (Hayden et al. 2000). Although this relationship is less definitive from the available data for GCWAs, this species is a host to brown-headed cowbirds and likely benefits from reduced cowbird parasitism. The cowbird control program has a significant beneficial effect for both BCVIs and GCWAs at Fort Hood.

### **Recreation**

The potential effects of recreation programs at Fort Hood to the BCVI and GCWA are expected to be insignificant. Fishing activities generally are not conducted in endangered species habitats. Effects of hunting generally would be limited to potential harassment where the hunting season overlaps the endangered species breeding season. Turkey and other bird hunting is often conducted in savannah or riparian habitats not typically occupied by endangered species. Deer hunting is conducted during the non-breeding season of endangered species populations and helps control the potential for over-browsing of endangered species habitat.

Mountain biking is restricted to the Belton Lake Outdoor Recreation Area (BLORA), which contains occupied habitat for the GCWA. Studies by A. Graber on Fort Hood and the Austin area in 2002 and 2003 indicated that GCWAs in habitat areas with recreational trail bike riding had lower reproductive success and larger home ranges (Graber, unpublished data). However, recent studies of GCWA populations at BLORA did not show mountain bike activity to have an adverse impact on the species (Pekins 2002).

### **Population Monitoring and Research Programs**

Monitoring and research programs on Fort Hood are designed to support an adaptive management approach for endangered species populations at Fort Hood. These activities will be modified as necessary to determine response of endangered species populations to actions implemented under the proposed ESMP revision. These data will allow installation natural resource managers to proactively respond to any observed changes in habitats or populations.

## B. ESMP Revision

### 1) Fort Hood Fire Management and Protection Policies

Under the proposed action, fires within the Live Fire Areas would be allowed to “let burn” under fire conditions Green and Amber. Historically, a “let-burn” fire management policy was in effect for the 50-years prior to listing the GCWA as endangered in 1990. During this period, ranges within the Live Fire Areas were subject to the full spectrum of weapons use that was essentially similar to present use including firing of direct and indirect artillery, incendiary devices, small arms, crew-served weapons, and aerial rocketry and munitions. With the exception of habitats burned during the 1996 wildfire, the current mosaic of BCVI and GCWA habitat reflects results of the pre-1990 fire regime. The pre-1990 fire regime resulted in conversion or maintenance of habitat to grassland or to shrub land habitats occupied by BCVIs. GCWA habitat within the Live Fire Areas typically persisted in areas within buffer zones between firing zones and were protected by topography or buffered by BCVI habitat with low fuel loads.

Installation surveys during the 1987-90 period indicated 50 percent of the known BCVI population on Fort Hood occurred within the Live Fire Areas. The lack of heavy mechanized training and limited personnel access within the Live Fire Areas provides essentially undisturbed habitats for GCWAs and BCVIs.

Available data for 1992 through 2003 (excluding the 1996 wildfires) indicates a loss of GCWA and BCVI habitat for all of Fort Hood under the current fire management policy (Table 3). During these years, 0.1 percent (0.2 ha [0.5 ac]) of all GCWA habitat burned occurred during the peak nest months April-June. Of the total BCVI habitat burned, 23 percent (28 ha [69 ac]) burned during the months April through June. The largest one-year loss of GCWA habitat was 65 ha (161 ac) in 1992. The largest one-year loss of BCVI habitat was 36 ha (89 ac) in 2003. Fires in the Live Fire Areas comprised > 80% of the fire totals shown in Table 3.

**Table 3. Area (hectares) of golden-cheeked warbler (GCWA) and black-capped vireo (BCVI) habitat burned during 1992-03 (excluding 1996).**

Species	Year											
	92	93	94	95	97	98	99	00	01	02	03	Avg.
<b>GCWA</b>	65	14	6	5	4	1	0	15	2	6	51	15
<b>BCVI</b>	9	11	12	14	26	0	0	4	0	4	36	11

Under the proposed action, fire frequency in endangered species habitats and area of habitat burned may increase over levels observed under normal conditions during the 1992-03 period. Most fires would be expected to occur within BCVI habitats in the Live Fire Areas, since these areas historically have been burned due to ordnance use and are typically the habitat type adjacent to target areas. Burning of these BCVI habitats would result in unsuitability for occupancy for a period of 1-5 years. It is expected that the overall habitat mosaic resulting from this policy would be similar to conditions resulting from the pre-1990 period when fires were allowed to burn.

Loss of GCWA habitat may also increase over 1992-2003 levels under the proposed action, but overall fire dynamics are expected to reflect pre-1990 conditions. Most current habitat within the Live Fire Area is located in buffer areas for range fans. GCWA habitat typically is not located within or adjacent to heavily impacted target areas, since these areas are subject to frequent fires. Fires that occur under the proposed let burn policy within GCWA habitat are expected to be relatively low intensity, since the habitat at Fort Hood typically does not carry fire well under conditions of Green and Amber. GCWA habitat that is burned at Fort Hood converts to BCVI habitat in 1-5 years depending on fire intensity and site characteristics. Virtually all GCWA habitat areas that were burned in the 1996 fires have been subsequently occupied by BCVI (Cimprich 2003). Burned GCWA habitat would be expected to become suitable for use by the species only after a minimum of 25-30 years with no subsequent disturbance.

Several factors associated with the proposed fire management policy would minimize potential effects to endangered species. Fort Hood would maintain restrictions on use of ordnance and incendiary devices as the fire danger rating increases (see Description of the Proposed Action). These restrictions reduce the likelihood of military-related fires as fire risk increases due to environmental conditions. Current fire management and suppression requirements would remain in effect under danger rating Red, which would reduce the possibility of uncontrolled wildfires in endangered species habitats. This includes the use of an on-call helicopter as a first-responder for fire suppression during fire condition Red. Additionally, Belton Lake forms a natural barrier that protects the two major portions of the GCWA core habitat from total loss due to a catastrophic wildfire.

The proposed let burn policy is anticipated to maintain the fire dynamics within the Live Fire Areas necessary to maintain high quality BCVI habitat and periodically reduce fuel loads that contribute to uncontrolled wildfires. BCVI habitat that burns may become suitable for use by the species within the subsequent five-year period. GCWA habitat that burns would be expected to regenerate to high quality BCVI habitat and further serve as a low-fuel load buffer for remaining GCWA habitats.

Fort Hood has established installation carrying capacity goals of 2,000 territorial GCWA males and 1,000 territorial BCVI males. Carrying capacity is the amount of habitat necessary to support a population at maximum densities. The established habitat requirement to meet these carrying capacity goals is 8,520 ha (21,053 ac) of suitable habitat for GCWAs and 4,170 ha (10,304 ac) of suitable habitat for BCVIs. These minimum habitat requirements are based on results of population viability analyses (USFWS 1996a, USFWS 1996b, Hayden et al. 2001) and meet or exceed regional recovery goals for these species (USFWS 1991, USFWS 1992). Habitat loss anticipated under the proposed action would not significantly affect viability of GCWA or BCVI populations either in terms of available habitat carrying capacity or total population size at Fort Hood.

Installation population goals are expressed as carrying capacity since the associated habitat measure provides a replicable and observable metric for tracking trends over time. This metric is complemented by ongoing demographic monitoring programs that validate parameter estimates on which carrying capacity estimates are based. As demographic parameter estimates or viability analyses are refined, the amount of habitat necessary to meet the carrying capacity goal

may be modified, but the goal itself would remain unchanged. The current habitat estimates to meet the established carrying capacity goal is likely a conservative estimate; that is, likely biased toward exceeding the actual habitat required to meet the carrying capacity goals.

## **2. Reduce Area Designated as ‘Core’ Habitat**

The purpose of designating habitats as “core habitat” is to identify habitat areas that would be subject to the Fort Hood Training Guidelines (Appendix A). The purpose of the training guidelines is to minimize habitat damage and harassment of BCVI and GCWA populations during the breeding season from land-based military training activities. This proposal would eliminate core habitat designation for all BCVI habitats. Core habitat designation for GCWAs would be reduced from the current 14,879 ha (36,767 ac) to the proposed 3,861 ha (9,541 ac). The GCWA core habitat provides a reserve of habitat that is not subject to threats from urbanization, fragmentation, agricultural use, or disturbance from training activities during the breeding season.

The types of military training activities that are restricted under the current training guidelines are not conducted in the Live Fire Areas. Vehicle maneuver, dismounted training, and temporary field training facilities are all conducted in maneuver ranges external to the Live Fire Areas. Endangered species populations in the Live Fire Areas would not be subject to harassment or habitat damage from these training activities. Therefore, core habitat designation for habitats in the Live Fire Areas are largely superfluous given the nature of training activities within this area and serve no purpose to protect populations and habitats.

Potential effects of removing training restrictions in maneuver areas include increased presence of troops and field training facilities in excess of two hours, and vehicles traveling off-road through habitats. These activities could result in increased harassment of individuals, direct mortality, nest loss, and/or damage to habitat as discussed under the effects of Ongoing Activities. Transient vehicle traffic on roads and trails and dismounted troop activity is not expected to increase in response to the proposed action since these activities occur in habitat whether or not it is designated as core habitat.

The reduction in the amount of core habitat for the GCWA is not anticipated to increase habitat fragmentation or isolation as a result of maneuver training activities. Prior to listing in 1990, GCWA habitat was only significantly affected by range clearing activities, such as the one conducted in Training Areas 2 and 4 in the mid 1980s. Such habitat clearing activities are addressed in the proposed programmatic take for such activities (see below).

The proposed action would also reduce the time period for implementing Level 2 restrictions in core habitat from 1 March to 30 June. The current time period for Level 2 restrictions was established to accommodate the breeding season of both the GCWA and BCVI occurring in designated core habitats. Under this proposed action, no BCVI habitat would be designated as core habitat, and therefore, minimization gained from Level 2 restrictions would only apply to the GCWA core habitat. The GCWA nesting and breeding season occurs from the first week of March through July, although some birds may stay as late as August. The majority of nesting behavior and territorial displays occurs from March through June. Few territorial songs are

heard after mid-July (Pulich 1976). The proposed changes in the Level 2 time period would accommodate the majority of nesting activity within designated core habitat.

### **3) Construction and Range Improvements**

Under the proposed action, a maximum of 325 ha (803 ac) of endangered species habitat may be permanently lost due to facilities construction and range improvements at Fort Hood. This would directly remove BCVI and GCWA habitat at the project sites and, depending on construction configuration, could lead to increased edge habitat and fragmentation. Effects of these construction activities are generally not equivalent to the impacts associated with urbanization. Typically, the constructed facilities (e.g., MOUT facilities) would have only intermittent human presence. Much of the habitat cleared for range improvements is converted to grassland, which would mimic the landscape matrix associated with non-urban habitats. Since the proposed programmatic take covers several potential projects located throughout the installation, the habitat loss from any one project would likely be on the scale of 10's of hectares. Construction conducted during the nesting season could result in loss of nesting attempts and dislocation of breeding adults.

Assuming a 2:1 ratio of GCWA to BCVI habitat loss under the proposed action, the 325 ha (803 ac) of habitat loss represents 1.0 percent and 1.6 percent of currently available habitat for the GCWA and BCVI, respectively. Construction activities may locally increase fragmentation of associated GCWA habitats including reduced patch size and increased ratio of edge to interior habitat, which may locally have adverse effects on productivity.

Improvements and construction of roads and trails for military training activities may enhance access of troops and vehicles to endangered species habitats. An example would be improved access to hilltop habitats that were not previously accessible. Potential effects of military unit use of endangered species habitats are discussed under the effects of Ongoing Activities.

Planning review by installation natural resource managers provides input on facility siting to minimize impacts on endangered bird habitats. This review occurs early in the planning process. The installation management, monitoring, and research activities described under Ongoing Activities would also assist in minimizing risk to population viability as a result of habitat loss from construction activities.

## **V. Cumulative Effects**

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

At this time, no future state, tribal, local or private actions are known to be planned within the action area. Because the action area encompasses the entire Fort Hood property, any future actions concerning the area would occur at Fort Hood and thus require a separate consultation.

## **VI. Conclusion**

After reviewing the current status of the BCVI and GCWA, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of the BCVI and GCWA. No critical habitat has been designated for these species, therefore, none would be affected.

The majority of the proposed action is composed of ongoing military training activities in conjunction with endangered species management, monitoring and research. Historically, military training activities have resulted in incidental take of the BCVI and GCWA, which has been well documented. It is anticipated that incidental take would continue to occur at Fort Hood at slightly elevated levels due to the proposed changes in the ESMP that allow the Army more flexibility for the training mission. Even at this elevated level, the years of monitoring and research conducted at Fort Hood indicate that the long term population viability of the BCVI and GCWA within the action area would be sustained. Most importantly, Fort Hood has committed to continue the management of endangered species at population levels that meet the regional recovery goal for each species.

In formulating this biological opinion, the Service considered the effects of the action to continue indefinitely, since the activities are ongoing so long as Fort Hood continues to operate. In so doing, the accompanying Incidental Take Statement addresses the anticipated incidental take associated with the proposed action over five-year periods as totaled from the annual take determination. The annual 'take' allowance was calculated based on past events and future needs of the military mission, while ensuring that the potential cumulative impact of the allowed take does not exceed a threshold that would be counter to the population management goals. That is, the amount of habitat loss allowed in the Incidental Take Statement could not exceed the ability to maintain the population goals in successive years. This consideration is especially relevant to the anticipated temporary loss of habitat, which largely occurs from wildfire, and eventually regenerates to suitable habitat for endangered species. Based on these factors, the anticipated incidental take is compatible with long term management of the BCVI and GCWA at Fort Hood.

## **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Army for the exemption in section 7(o)(2) to apply. The Army has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Army fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Army must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement. [50 CFR §402.14(i)(3)].

### **Amount or Extent of Take Anticipated**

The Service anticipates that the proposed action would result in the incidental take of BCVIs and GCWAs. Take would be in the form of harm, harassment, wounding, and/or killing. Take, in the form of harm and/or harassment, is difficult to quantify and usually cannot be estimated in terms of numbers of individuals. However, because the area of habitat for both species is known for the action area, the maximum amount of incidental take allowed under this biological opinion is given in terms of habitat area with regard to harm, and nests and/or nesting attempts lost with regard to harassment, wounding and/or killing.

The incidental take exempted in this statement, with the exception of that related to construction and range improvements, is estimated over five-year increments. That is, barring the need for re-initiation, incidental take related to military training and other activities not including construction and range improvements, should not exceed the anticipated levels authorized in this statement within each successive five-year period. Incidental take related to construction and range improvements is authorized over the immediate five-year period following the date this biological opinion is issued.

Based on 11-years of fire data from 1992-2003 (excluding the 1996 catastrophic wildfire), an average of no more than 72 ha (178 ac) of BCVI habitat would be expected to burn annually. Based on the same data set, Fort Hood anticipates that GCWA habitat loss to fire would average 130 ha (321 ac) annually under the let-burn proposal. These estimates represent the upper range of expected fire effects and reflect a “worst” case for habitat loss due to fire under normal environmental, training and fire control procedures as applied under the proposed action.

The estimated incidental take of endangered species due to fire is based on the worst year of habitat loss for each species during the 1992-03 period (excluding 1996) with a multiplier of two to account for the possibility of increased fire frequency and area under the let burn policy. This results in a maximum estimated loss of 650 ha (1606 ac) of GCWA habitat (65 ha/year x 2 x 5 years) over the next and subsequent five-year periods. A maximum loss of 360 ha (890 ac) of BCVI habitat (36 ha/year x 2 x 5 years) is estimated over the next and subsequent five-year periods. These totals comprise 3.0 percent and 5.2 percent of the total habitat currently estimated for GCWAs and BCVIs, respectively. GCWA habitat that regenerates to BCVI habitat after a

burn will partially offset loss of BCVI habitats that burn. Additional harm to the GCWA resulting from vehicle training activities within suitable habitat is estimated to be 10 hectares (25 ac) over the next and subsequent five-year periods.

The seven observed instances of BCVI nest loss or potential nest disturbance represent 1.7 percent of the observed nest attempts in the intensively monitored areas. Based on this percent and using conservative estimates of the total number of BCVIs on Fort Hood, mating success, and incidence of re-nesting, it is anticipated that no more than 30 nests annually or 150 nests over five years would be lost by training activity in proximity to nest locations. Take of GCWA through harassment is less likely, but may occur where vehicles and/or personnel frequent the edge of habitat. This low likelihood is anticipated to be less than one percent of nest attempts in habitats not designated as core. Based on a minimum current population estimate of 2,900 territorial males and observed nesting, one percent of nest attempts would equal approximately 25 nests annually or 125 nests over five years.

The proposed action estimates incidental take of endangered species through permanent habitat loss due to construction and range improvements over the next five years. Based on current estimates, it is anticipated that 217 ha (536 ac) of GCWA and 108 ha (267 ac) of BCVI habitat would occur over the next five years as a result of the proposed construction and range improvements. A summary of incidental take authorized in this statement is given in Table 4.

**Table 4. Summary of potential incidental take of the black-capped vireo (BCVI) and golden-cheeked warbler (GCWA) resulting from proposed action. Take is estimated in terms of habitat impacts (hectares) and nests and/or nesting attempts lost (nests).**

Activity	BCVI	GCWA
Incidental take anticipated from training activities over the next 5-year period and successive 5-year periods.	360 hectares, 150 nests	660 hectares, 125 nests
Incidental take anticipated from construction and range improvements over the next 5-year period.	108 hectares	217 hectares

### Effect of the take

In the accompanying biological opinion, the Service determined that the level of anticipated incidental take is not likely to result in jeopardy to the BCVI or GCWA.

### Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the GCWA and BCVI:



- 1) Continue to implement monitoring and research programs for the GCWA and BCVI.
- 2) Manage vegetation clearing projects to minimize fire hazard from slash, and avoid impacts to residual stands.
- 3) Emphasize the use of prescribed burning to support protection and maintenance of endangered species habitat, and support ecosystem management principles.
- 4) Evaluate the effects of predation on endangered species productivity, and investigate management options to reduce nest losses.
- 5) Monitor the quality and quantity of available endangered species habitat.
- 6) Incorporate preventative measures to avoid future uncontrolled burns similar to the February 1996 fires.
- 7) Implement training restrictions in GCWA Core Habitat.
- 8) Monitor the distribution and spread of oak wilt, and use appropriate measures to limit effects on endangered species habitat.
- 9) Restrict recreational use in endangered species habitat.

### **Terms and conditions**

In order to be exempt from the prohibitions of section 9 of the Act, the Army must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

- 1) Continue to implement monitoring and research programs for the GCWA and BCVI.
  - a) Document population trends and assess population status of the BCVI and GCWA.
  - b) Evaluate the effects of de-designation of Core Habitat on GCWA and BCVI demography and productivity.
  - c) Evaluate the relationship between habitat quality and GCWA abundance and productivity.
  - d) Evaluate fire-related dispersal patterns of GCWAs.

e) Continue to allow safe access to training and Live-Fire Areas for BCVI and GCWA surveys during the period of March 15 through July 31 to ensure that equivalent data is collected for study areas both in and out of the Live Fire Area. It is important that the integrity of data collected from existing BCVI and GCWA productivity, predation and population trend studies is maintained.

f) Continue to generate color sequences for range-wide color banding of BCVI and GCWA through cooperation with the Service.

g) Investigate the dispersal of GCWAs and BCVIs from Fort Hood to surrounding areas through cooperative studies with other researchers and at Corps of Engineers property at Lake Belton and Stillhouse Hollow Lake.

2) Manage vegetation clearing projects to minimize fire hazard from slash, and avoid impacts to residual stands.

a) During juniper clearing or other brush removal projects, construction of firebreaks, power line right of ways, roads, etc., avoid piling material around or against residual standing trees. Ensure that slash material is pulled away from standing live trees and removed from the site, burned, or mulched in place. Slash disposal methods will be included in the scope of proposed projects.

b) Where possible, mulching slash material on site is preferable to removal or burning, in order to return nutrients to the soil and reduce erosion.

c) As an integral part of project design, maximize the use of preventative measures to minimize soil loss after vegetation removal. Examples include re-seeding with native herbaceous plant seed, deferral of grazing from rehabilitation sites, placement of water bars on slopes, and using waste material in gullies as appropriate.

d) All vegetation clearing projects must include coordination with Natural Resources Management Branch from the planning phase forward in order to minimize or avoid impacts to endangered species and their habitat, and must support overall objectives of the INRMP, of which the ESMP is a part.

e) Develop a habitat regeneration/enhancement plan that is compatible with endangered species management and mission training requirements.

3) Emphasize the use of prescribed burning to support protection and maintenance of endangered species habitat, and support ecosystem management principles.

a) All prescribed burning must be overseen by Natural Resources Management Branch personnel certified and experienced in prescribed burning techniques, and support the overall objectives of the INRMP.

- b) Identify areas suitable for maintenance as BCVI habitat and implement habitat management prescriptions as necessary.
  - c) Use prescribed fire to the maximum extent possible to reduce fuel loads near important areas.
  - d) Use prescribed fire to maintain prairie sites and to inhibit development of pure juniper stands. Fire should be considered as a low-cost, non-invasive means of avoiding future need for destructive large-scale mechanical clearing projects.
- 4) Evaluate the effects of predation on endangered species productivity, and investigate management options to reduce nest losses.
- a) Investigate species-selective methods for control of imported fire ants in endangered species habitat and near important karst features.
  - b) Continue to control feral hog population utilizing aerial support and trapping, and evaluate effectiveness of control methods.
- 5) Monitor the quality and quantity of available endangered species habitat.
- a) Continue use of helicopter over-flights as needed to ensure compliance with training guidelines, monitor effects of training activity in endangered species habitat, and monitor oak wilt centers.
  - b) Evaluate habitat trends based on change detection imagery every five years.
  - c) Maintain adequate natural resource law enforcement presence to effectively monitor land use, and enforce training guidelines and off-road vehicle restrictions.
  - d) Refine mapping efforts to enhance endangered species information management on Fort Hood.
- 6) Incorporate preventative measures to avoid future uncontrolled burns similar to the February 1996 fires.
- a) Increase fire prevention and response efforts by:
    - (i) coordinate with the Fire Department and Natural Resource Management Branch during the decision to approve/disapprove Range Condition Red waivers;
    - (ii) maintain and upgrade fire-fighting capabilities including aerial support, subject to the availability of funds.
  - b) Continue research on the effects of the 1996 burn.

7) Implement training restrictions in GCWA Core Habitat.

a) Implement *Training Guidelines for Use of Endangered Species Habitat* (Appendix A) at two levels. Level 1 applies from July 1 through February 28. Level 2 is more restrictive, and applies from March 1 through June 30.

b) Provide orientation and training for appropriate personnel on the implementation of the guidelines.

8) Monitor the distribution and spread of oak wilt, and use appropriate measures to limit effects on endangered species habitat.

a) Develop and maintain a current map of oak wilt centers, with particular emphasis on training areas where core endangered species habitat occurs.

b) Identify and prioritize oak wilt centers which threaten, or may potentially threaten, core habitat.

c) Investigate treatment and/or isolation methods which might be feasible to limit oak wilt effects.

d) Implement appropriate measures based on priority evaluation.

e) If fungal mats are identified on trees that necessitate removal of that tree during the breeding season, a representative of the Natural Resource Management Branch will be present to ensure that the tree is not being directly utilized by the GCWA as a nesting site. Every effort will be taken to avoid or minimize a direct impact to listed species as a result of management for oak wilt.

f) Investigate the effects of oak wilt on GCWA habitat.

9) Restrict recreational use in endangered species habitat.

Prohibit the use of motorized off-road recreational vehicles in endangered species habitat.

## Reporting Requirements

The results of all surveys and studies specified in this biological opinion will be reported to the ARLFO by December 31 of the year the studies are conducted.

## Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to

help implement recovery plans, or to develop information. The following recommendations are provided for consideration by the Army:

- 1) Fort Hood contains important karst ecosystems that provide habitat for several cave invertebrates and one species of salamander that appear to be endemic. Considering the status of similar karst invertebrates and salamanders endemic to the Edwards Plateau region, Fort Hood is encouraged to continue monitoring and managing the habitat of these species. This would include the development and implementation of a management plan and providing adequate protection of these ecosystems.
- 2) Fort Hood is encouraged to consider BCVI and GCWA habitat when implementing Compatible Use Buffer activities. This would include extending management and monitoring activities to adjacent lands utilized for buffer purposes when possible.
- 3) Fort Hood is encouraged to continue work on an off-site conservation plan that would support the on-the-ground work of non-governmental organizations dedicated to the conservation of the BCVI and GCWA.

#### **Reinitiation Notice**

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The Service appreciates the cooperation extended by the Army staff and participating parties during this consultation. If further assistance or information is required, please contact Mr. Omar Bocanegra or myself at the above address or telephone (817) 277-1100.

Sincerely,



Thomas J. Cloud, Jr.  
Field Supervisor

cc: State Administrator, Ecological Services, Austin, TX  
Regional Director, FWS, Albuquerque, NM (Attn: ARD-ES)

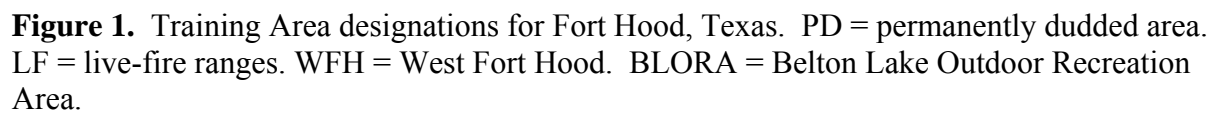
## LITERATURE CITED

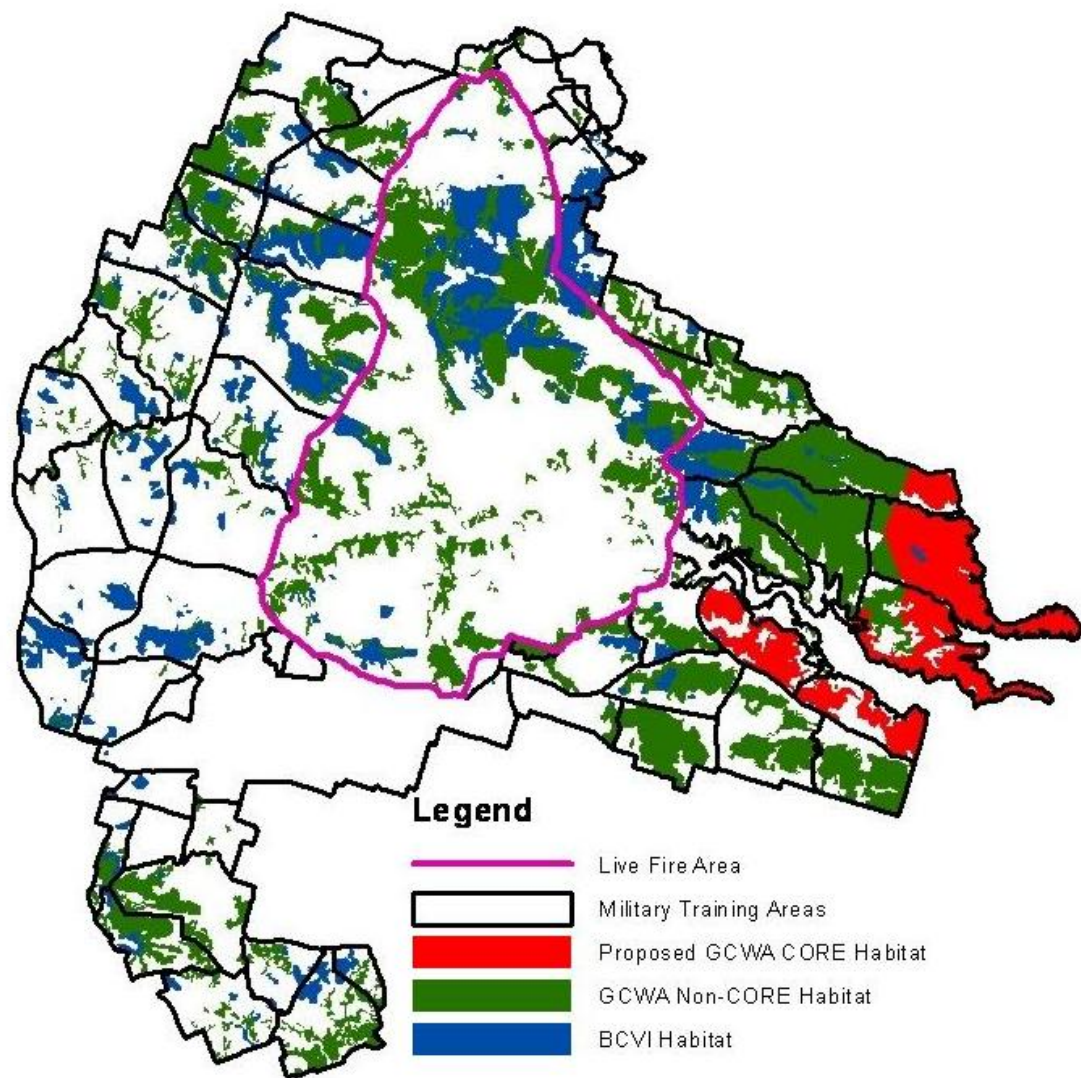
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**Figure 2.** Current distribution of endangered species habitat and GCWA habitats proposed for designation as “core” on Fort Hood, Texas.

## APPENDIX A

### TRAINING GUIDELINES FOR USE OF ENDANGERED SPECIES HABITAT

*Guidelines are implemented at two levels. Level 1 applies from 1 July through 28 February. Level 2 is more restrictive, and applies from 1 March through 30 June. The hierarchical structure allows greater utilization of habitat during the period when the endangered species are not present, while providing adequate protection during the nesting period. Guidelines should be used in conjunction with a 1:50,000 training area map with current endangered species habitat overlay.*

#### LEVEL 1 RESTRICTIONS (applicable from 1 July through 28 February)

1. Report all fires to Range Control. Do not start fires.
2. Use previously established firing points, fighting positions, and emplacements only. All digging must be cleared by the Directorate of Public Works (DPW) through approval of an excavation permit, form FHT 420-X10.
3. Comply with range rules regarding use of flares, incendiary munitions, etc. Ensure that firefighting equipment and personnel on hand are in compliance with Fire Danger Rating SOP.
4. Park equipment in open areas only. Do not cut brush or trees for camouflage, road blocks, or other purposes.
5. Use existing roads and trails. Do not drive vehicles through or over woody vegetation.
6. Do not tamper with, or release birds from, cowbird traps. Traps are serviced regularly and are an essential component of the endangered species management program.

#### LEVEL 2 RESTRICTIONS (applicable from 1 March through 30 June)

ALL LEVEL 1 RESTRICTIONS, PLUS THE FOLLOWING:

7. Occupation of habitat areas is limited to drive-through on existing trails, or emergency stop only. No bivouac or other long-term posts are permitted within habitat areas. Long-term is defined as exceeding 2 hours in duration.

*NOTE: Due to difficulty in providing adequate detail at 1:50,000 map scale, habitat overlays sometimes obscure open areas within habitat blocks where some limited long-term use is possible. Proposed use of open areas within habitat must be coordinated with and approved by*

*DPW, Natural Resources Management Branch personnel on a case-by-case basis. Arrange for site visit during earliest planning stages (287-2885).*

8. No use of obscurant smokes or other chemical agents in or within 100 meters of habitat.

*Guidelines are intended to minimize actions which cause physical damage to habitat or disturb nesting. Careful planning and use of current habitat maps are necessary to avoid conflict and possible disruption of training activities in the field. If in doubt regarding acceptable locations or activities in or near habitat, contact DPW, Natural Resources Management Branch at 287-2885.*

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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				5b. GRANT NUMBER	
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6. AUTHOR(S)  John D. Cornelius, Timothy J. Hayden, and Patrick A. Guertin				5d. PROJECT NUMBER	
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13. SUPPLEMENTARY NOTES					
14. ABSTRACT Fort Hood Military Reservation is an 87,890-ha U.S. Army installation located in central Texas. It is one of the Army's premier installations, providing training facilities for the full range of mission requirements, including maneuver exercises for units up to brigade level, firing of live weapons, and aviation training. The presence of Federally listed endangered species on Fort Hood is a significant natural resource management challenge for the Army and Fort Hood. In accordance with the Endangered Species Act of 1973, as amended, the Army must assist recovery of all listed threatened and endangered (T&E) species and their habitats under the installation's management authority. Army Regulation (AR) 200-3 requires installations to prepare an Endangered Species Management Plan (ESMP) for all listed and proposed T&E species. The installation ESMP should be used as a tool to achieve conservation objectives for populations of listed and proposed T&E species and to minimize impacts on the training mission. AR 200-3 further encourages, but does not require, the development of ESMPs for all candidate species, and recommends that an integrated ESMP covering all T&E species be prepared if more than one such species occurs on an installation. The U.S. Fish and Wildlife Service Biological Opinion for Fort Hood (March 2005) provides requirements and guidance for endangered species management on Fort Hood. This ESMP is written specifically for use by natural resource managers and leaders of training operations on Fort Hood to accomplish military training objectives while meeting conservation objectives for T&E species. The objective of this ESMP is to provide a comprehensive plan for maintaining and enhancing populations and habitats of Federally listed endangered species and species of concern on Fort Hood while maintaining mission readiness in a manner consistent with Army and Federal environmental regulations.					
15. SUBJECT TERMS Black-capped vireo                      Endangered species                      Salamander Cave-adapted fauna                      Golden-cheeked warbler                      Texabama Croton					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
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